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The Convair F2Y-1 "Sea-Dart," world's first delta wing seaplane, is a jet-powered U.S. Navy fighter that blends the high-speed land-based airplane's performance with the water-based airplane's versatility and mobility. ZENITH skill and experience in reinforced plastics fabrication contribute to the fighting effectiveness of this newest development in combat craft of the air.

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Aviation Week

Volume 59 — December 7, 1953 — Number 23

Editorial Offices: 330 W. 42nd St., New York 36. Tel. Longacre 4-3000
National Press Bldg., Washington 4, D. C. Tel. National 8-3414
1111 Wilshire Blvd., Los Angeles 17, Calif. Tel. Madison 6-4323

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AVIATION WEEK • December 7, 1953 • Vol. 59—No. 23
Member ABP and ABC

Published weekly by McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. **Publication Office: 99-129 North Broadway, Albany 1, N. Y.**
Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.
Subscriptions: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow 10 days for change of address.
Subscriptions are solicited only from persons having a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.
Single copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par; other Western Hemisphere, $10 a year; $16 for two years; $20 for three years. All other countries $20 a year; $30 for two years; $40 for three years. Entered as second-class matter, July 16, 1947, at the Post Office at Albany, N. Y., under Act of Mar. 3, 1879. Printed in U. S. A.

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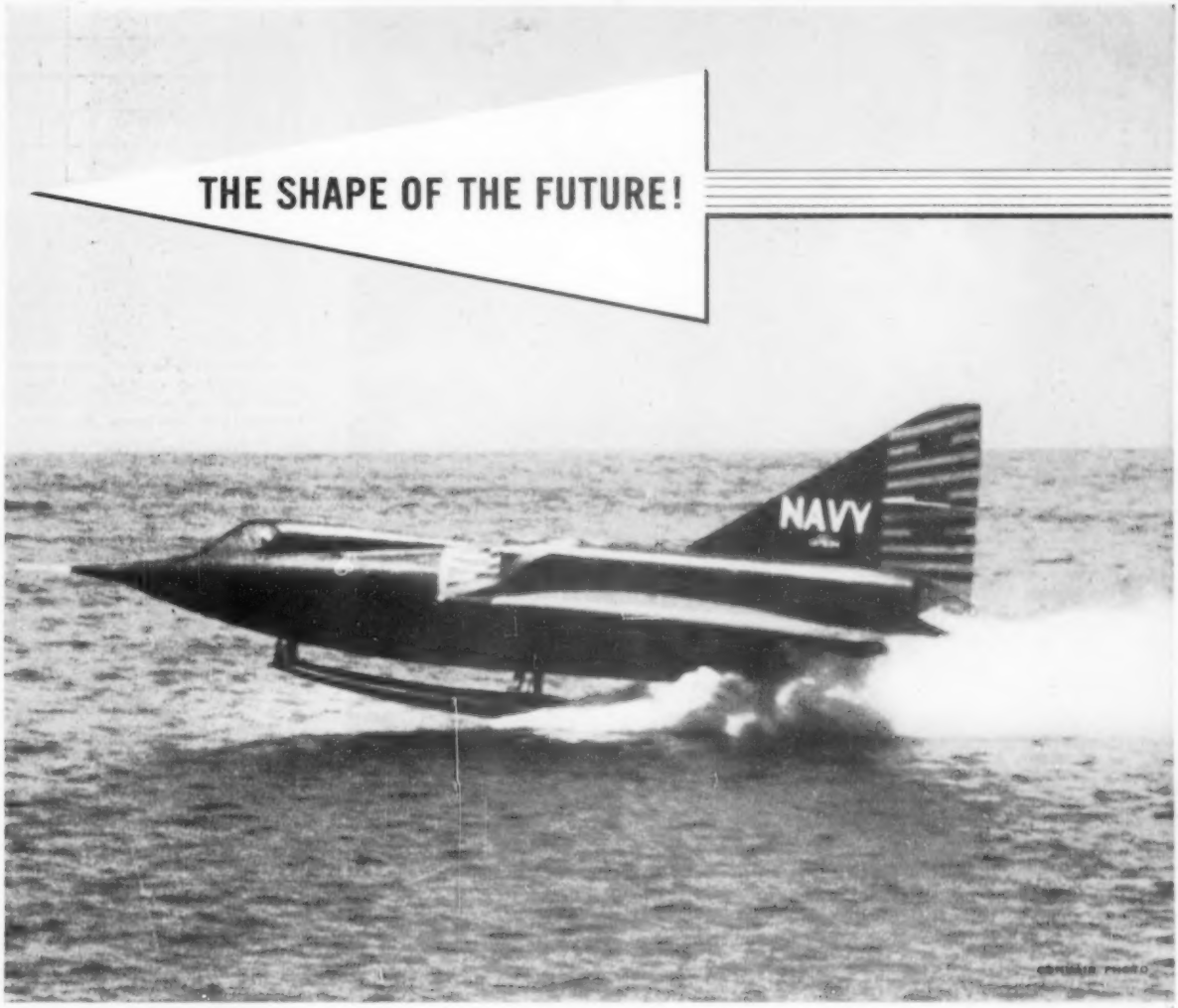

A FLYING TRIANGLE TAKES OFF! The XF2Y "Sea Dart," sensational new U.S. Navy jet fighter, is shown taking off from San Diego Bay on its retractable "hydro-skis." Designed and built by Convair, the "Sea Dart" is the world's first delta wing (triangle-shaped) seaplane and uses two Westinghouse jet engines and Afterburners.

SOLAR PUT THE STINGER IN THE TAIL!

THE "SEA DART" DEPENDS on its Afterburners for tremendous bursts of extra power for fast takeoffs and rocket-like climbs. Afterburners are used on all the newest U.S. jet fighters. Afterburners make possible great boosts in jet power by burning extra fuel in the jet engine's exhaust, where hot gases roar at cyclonic speeds and at temperatures that melt steel like butter.

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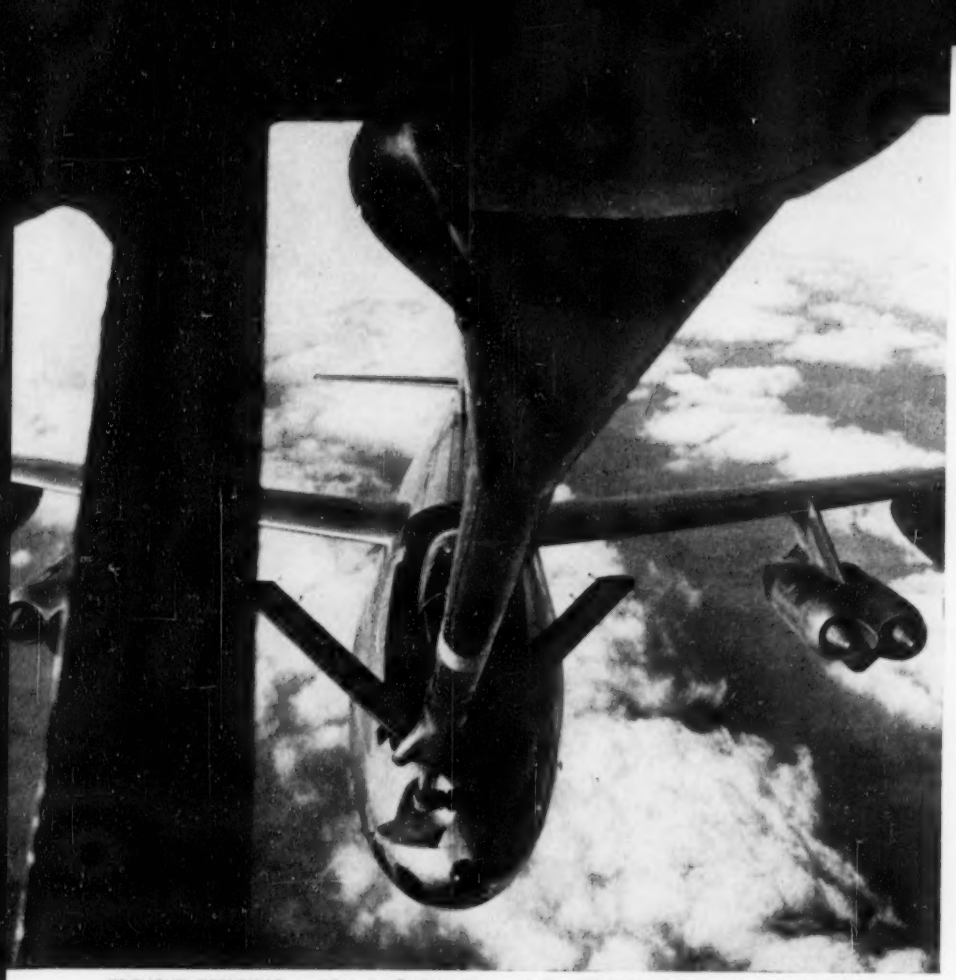

IN-FLIGHT REFUELING enables the B-47 to fly more than 12,000 miles non-stop. A vital factor in establishing rendezvous points is fuel consumption rate, measured on the B-47 by the G-E mass flowmeter.

Radically New G-E Fuel Flowmeter Gives True Mass Readings in Pounds per Hour

Jet engine fuel consumption can now be measured accurately at all operational altitudes and temperatures. A new kind of flowmeter, developed by General Electric, gives direct pounds-per-hour readings that are accurate regardless of density variations.

By measuring the mass of fuel consumed this revolutionary flowmeter averts the error factor inherent in earlier systems. It is the first true mass flowmeter in large-scale production.

In use on the B-47 Stratojet, the G-E mass flowmeter is proving its value as a cruise control instrument. The unusually long-range missions flown by the B-47 require utmost dependability in the indication of fuel consumption rate. The mass flowmeter also assures precise setting of fuel flow in starting engines, thereby helping to prevent overheating.

A complete mass flowmeter system has three lightweight components—indicator, transmitter, and a shock-mounted power supply. One power unit can supply as many as eight transmitters. Pressure drop in the transmitter is very slight, making possible two important advantages: (1) no additional fuel pumping capacity is needed; (2) the transmitter can be mounted in the low-pressure section of the fuel line near the fuselage.

For more information, ask your G-E Aviation Specialist for Bulletin GEC-932. Or write to Section 210-82, General Electric Company, Schenectady 5, New York.

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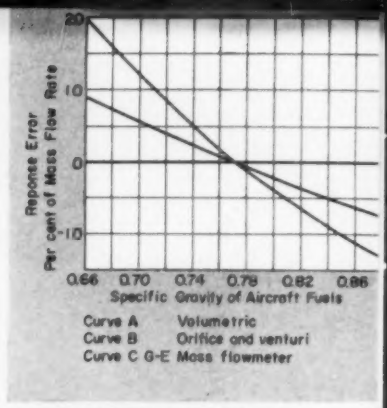


1. FUNDAMENTAL RESPONSE errors of the other two main types of flowmeter are contrasted with accurate response of G-E mass flowmeter.

2. INDICATOR has easy-to-read expanded scale that shows rate of fuel consumption in pounds per hour. Maximum weight: 0.6 lb.

3. TRANSMITTER gives readings up to 12,000 pph of mass flow. It will withstand 200 psi pressure. Maximum weight: 5.5 lb.

4. POWER SUPPLY has a 28-v constant-speed motor. Filters keep radio noises within Spec. MIL-I-6181. Maximum weight: 5.0 lb.

NEWS DIGEST

Domestic

Two Northrop F-89C all-weather interceptors were involved in accidents on two consecutive days during simulated combat maneuvers at Truax Field, Madison, Wisc. One F-89C was found crashed in a marsh near Madison. The other plane still is missing. USAF recently returned F-89s to service after extensive structural modifications (AVIATION WEEK Nov. 9, p. 11), ordered after a series of accidents in 1952. USAF has no present plans to ground the F-89s again as a result of the Wisconsin crashes.

C-46 operators must modify the transports to meet current safety standards by Mar. 31 or stop using the twin-engine planes for passenger flights, Civil Aeronautics Board rules. Aircraft Engineering Foundation (see p. 108) had asked the Board to extend the deadline to June 30.

Dissatisfied stockholders in Timm Aircraft Corp., Glendale, Calif., have proposed a new slate of company directors and formed a shareholders committee to battle for proxies in anticipation of the firm's annual meeting Dec. 15. Timm production includes subcontract work for Northrop Aircraft.

New rocket engine plant will be constructed for Navy's Bureau of Aeronautics at Rockaway, N. J., and operated by Reaction Motors, Inc. Approximate cost of the 150,000-sq. ft. facility: $3.5 million.

American Airlines has leased 76 acres on New York Idlewild International Airport at a cost of more than $3,363,000 for 22 years, plans to spend a minimum of $5 million by 1960 in expanding its facilities at the field.

Charles A. Lindbergh has won the Daniel Guggenheim Award for 1953 for "pioneering achievements in flight and air navigation" during the past 25 years, will receive the medal Jan. 25 at the Honors Night Dinner of the Institute of the Aeronautical Sciences in New York.

Jet engine test facility at Arnold Engineering Development Center, Tullahoma, Tenn., is scheduled to be completed and ready for shakedown runs in January. First part of the unit—six exhaust compressors that will create rarefied atmospheres corresponding to altitudes up to 80,000 ft.—last week was turned over to Aro, Inc., operating contractor of the USAF Research and Development Command center.

NAA Delivers 50,001st Plane

First production F-100 Super Sabre to roll out of North American Aviation's strike-crippled Los Angeles plant is delivered to U. S. Air Force, the 50,001st plane produced by NAA. North American vice president-manufacturing, J. S. Smithson, turns over the 754.9-mph. holder of world's speed record to Lt. Col. William F. Barns.

New transcontinental aircoach service will be inaugurated next week by Northwest Orient Airlines, flying DC-6Bs from New York to Seattle. The service follows start of NWA coach flights from Seattle and Portland to Hawaii last week and makes possible the first one-plane through service from the East Coast to Hawaii.

Dr. W. F. Durand, aeronautical engineering pioneer, last week was awarded a special citation at the 50th anniversary luncheon honoring the engineers' contribution to powered flight by the American Society of Mechanical Engineers, Institute of the Aeronautical Sciences and Society of Automotive Engineers. Award was made by Dr. J. C. Hunsaker.

Avco Manufacturing Corp. has consolidated its Lycoming-Spencer and Bridgeport-Lycoming operations into a single division, expects the move to strengthen the competitive position of its powerplant producers and allow expansion and integration of engine research.

National Airlines returned to Newark (N. J.) Airport last week, operating out of the field for the first time since it was closed by a series of crash investigations in February 1952.

East Side airlines terminal, New York's new $7-million passenger traffic center (AVIATION WEEK Nov. 2, p. 75), officially opened its doors last week at dedication ceremonies presided over by O. M. Mosier, executive vice president of American Airlines.

Kim Sigler, former governor of Michigan (1947-48) and a leader in that state's aviation activities, was killed last week when his Beechcraft Bonanza struck a guy wire of a 584-ft. television tower near Battle Creek, Mich., spun to the ground and exploded. Three passengers in the plane also died.

William H. Shippen, Jr., 52, aviation writer for the Washington (D. C.) Star and World War II public relations director for Bell Aircraft Corp.'s Marietta (Ga.) Division, died of a heart attack last month.

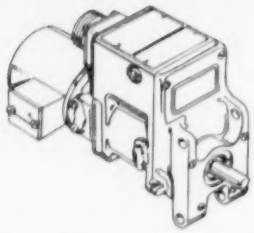
Financial

Lockheed Aircraft Corp., Burbank, Calif., has declared a quarterly dividend of 50 cents plus an extra 25 cents and a 5% stock dividend on each share outstanding Dec. 4. The 50-cent dividend, payable Dec. 15, represents an increase of 12½ cents on previous quarterly dividends for 1953.

International

Japan Air Lines announced last week it will expand into trans-Pacific aircoach service next April, two months after inauguration of San Francisco-Tokyo flights in February.

AIRBORNE ACTUATOR *for Navy's Guardian*



The ram air inlet door on this new Grumman sub-hunter is actuated by Airborne's R-412M5 Actuator. Other models and similar Airborne electromechanical units are standard equipment in many service and civilian aircraft. Their wide range of applications is evidence of their great dependability.

If you have a design problem where high power and small space are factors, see our literature in the I.A.S. Aeronautical Engineering Catalog, or write direct to us.

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Washington Roundup

New ATA President?

Earl Dallam Johnson, 48, Undersecretary of the Army, probably will be named president of the Air Transport Assn. shortly after the annual membership meeting Dec. 16. He would succeed Vice Adm. Emory S. Land, 74, who has held the post since 1946 after wartime service as head of the Maritime Commission.

Johnson is an Air Force pilot, served during World War II in the Ferrying Division of Air Transport Command. His civilian experience has been in investment counseling. Johnson was appointed Assistant Secretary of the Army in 1950 during the Truman Administration.

Defense Shift

Pentagon insiders notice a gradual improvement in relations between Defense Secretary Charles E. Wilson, his Deputy Secretary, Roger Kyes, and the Air Force. Wilson speeches have been emphasizing the need to remodel U.S. strategy around the new atomic weapons while Army and Navy secretaries have been plugging for retention of traditional weapons on the ground that atomic weapons "may" be outlawed by international agreement.

New Defense Department budget is expected to reflect a mild departure from the "balanced force" concept that split fiscal 1954 money evenly among the services.

USAF is expected to get a slightly larger slice of the defense dollar, but the estimated increase will fall far short of balancing the $4-billion slash in aircraft procurement (both USAF and Navy) made by the Republicans in the fiscal year 1954 budget. Wilson already has ordered manpower cuts for Army and Navy while allowing USAF to retain its projected 970,000-man level.

Guided Missiles Abroad

USAF flatly denies that it plans to deploy guided missiles units abroad or store missiles in foreign countries, but it has been a poorly kept Pentagon secret that plans have been in the mill to send a guided missile group to England next spring equipped with Martin B-61 Matador pilotless bombers. Matador tactical units have been training for field service on the USAF long-range missile proving ground at Cocoa, Fla.

Record Aircraft Sales

Aircraft industry gross sales will reach a postwar record total of $8 billion for 1953, according to a prediction by DeWitt C. Ramsey, president of the Aircraft Industries Assn. The 1953 sales prediction is nearly double the $4.3-billion sales for the industry in 1952. Ramsey warned that declining military production schedules may bring a serious crisis in the industry by 1956 unless a sound military aircraft procurement program is organized soon.

Godfrey's Switch to SAC

Navy is boiling over television star Arthur Godfrey's recent speech at the Dallas air power symposium calling for a strong strategic air force as the nation's top priority defense need.

Godfrey arrived at the Dallas symposium shortly after a Michigan deer hunting expedition with Defense Secretary Charles E. Wilson and SAC Commander Gen. Curtis E. LeMay. Godfrey, who is a Naval Reserve pilot and has plugged the Navy publicly in the past, was introduced at Dallas by Vice Adm. John Dale Price, who had been instrumental in getting Godfrey's Naval pilot ratings when he was chief of Naval Air training at Pensacola.

But there was noticeable coolness between Price and his former protege after the speech. James H. Smith, Jr., Assistant Secretary of the Navy for Air, held a Dallas press conference to offer rebuttal to Godfrey's speech.

Off-Shore Problem

USAF evaluation team has just returned from Europe after another flight test evaluation of the European aircraft being considered for further off-shore procurement financed by U.S. funds. Team flew the British Hawker Hunter and Supermarine Swift day fighters and Javelin night fighter and the French Mystere day fighter.

Willis Promotion

Charles Willis, former nonscheduled air cargo operator who is a White House aide in the Eisenhower Administration, received a promotion recently when he was sworn in as the assistant to Sherman Adams, assistant to the President. Previously, Willis was one of the many special assistants in Adams' office. Among other things, Willis handles White House liaison with ACC.

More Knots

Pressure from the military, Air Transport Assn. and Air Line Pilots Assn. has spurred Civil Aeronautics Board to propose again amendment of Civil Air Regulations to convert speed and distance requirements from statute miles and miles per hour to nautical miles and knots. First proposal was rejected by CAB in May 1952. If approved, the switch to knots would become effective about July 1, 1954. CAB will receive arguments until Jan. 4.

White House Decisions

White House, already undecided on whether to approve the Eastern-Colonial Airlines merger, must face several equally important international route decisions next year. These include the globe-girdling trans-Pacific route case and the trans-Atlantic cargo case (both awaiting CAB examiner recommendation), and the Balboa service case on New York-South American interchange between Eastern and Pan American on the one hand and Braniff and National on the other. This is slated for oral argument before CAB Dec. 12.

Important competitive domestic route cases—to be decided by CAB, but possibly with the advice of White House—include: Slick-Flying Tiger Line merger (CAB heard oral argument more than a month ago, apparently is having a hard time reaching a majority opinion); New York-Chicago route case (examiner hearing still in progress); Northeast-Southwest route case (awaiting further CAB clarification of issues before examiner schedules hearing); and Denver service case (examiner hearing slated for Jan. 18).

—Washington staff

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WHO'S WHERE

In the Front Office

John R. Alison, onetime Assistant Secretary of Commerce for Aeronautics and member of NACA 1947-49, is new administrative vice president of Northrop Aircraft, Hawthorne, Calif.

William A. Uline and **William C. Moore**, both formerly with Bendix Aviation Corp's Scintilla Magneto Division, have organized Allied Precision Industries Sales and Engineering Corp. at Geneva, Ill., as president and vice president.

A. W. Morgan, former executive at Consolidated Vultee Aircraft Corp. and Hughes Aircraft Co., has been appointed executive vice president and general manager of Pachmayr Gun Works, Los Angeles.

Clarence Francis, chairman of General Foods Corp., has been elected to the board of Bendix Aviation Corp., Detroit. **Larry Eigenrauch** has become sales manager of Eclipse-Pioneer Division foundries at Teterboro, N. J., and **Willard Neuert** is new production manager.

Gill Robb Wilson, special assistant to the president of United States Freight Co., and **Hal A. Kroeger**, New York management consultant, have been elected directors of Air Associates, Inc., Teterboro, N. J.

Changes

C. H. Sharp has been promoted to general manager of H. H. Buggie, Toledo, Ohio. Other changes in the electronics firm: **C. R. Thorpe**, chief engineer; **R. J. Melcher**, special projects engineer.

Eph Howard has been appointed manager of the ramjet branch of the engine test facility at Arnold Engineering Development Center, Tullahoma, Tenn.

Richard Barkle is new assistant to the vice president—public relations of Northwest Orient Airlines.

Carl F. Brown, formerly with Lockheed Aircraft Corp. and Glenn L. Martin Co., has become manager of Federal-Mogul Corp.'s Greenville (Mich.) Division.

Leslie B. Tollaksen has been appointed manager of technical products for Remler Co., San Francisco electronics producer.

Larry Olenik is manager of National Airlines' new public relations branch and news bureau in New York.

Gordon J. Rice has been named defense contract manager for Borg-Warner Corp.'s Norge Aircraft Division.

Elmer R. Kramber has been promoted to revenue accounting manager for Western Air Lines.

Honors and Elections

Igor I. Sikorsky, engineering manager of United Aircraft Corp.'s Sikorsky Aircraft Division, this week received the University of Denver school of aeronautics' 1953 award as "aviation's outstanding man of the year."

Joaquim de Brito Subtil, Portugal representative on the council of International Civil Aviation Organization, is new chairman of the ICAO Committee on Joint Support of Air Navigation Services.

INDUSTRY OBSERVER

► Boeing has installed a new version of the Pratt & Whitney J57 split-compressor turbojet in its B-52 Stratofort with a thrust of more than 10,000 lb. Original J57 models in the experimental B-52s delivered 8,700 lb. thrust. Production models of the B-52A are scheduled to get the higher thrust engines.

► **Although USAF still is supporting development of the Convair XB-58 supersonic bomber as eventual successor of the B-52, Boeing is developing a competitor for the Convair project in its Wichita plant. The Boeing project is expected to emerge as a supersonic version of the B-47 Stratojet.**

► National Advisory Committee for Aeronautics expects to gather considerable data on the performance of stubby straight wings with modified double-wedge airfoils in the transonic range from its projected flight test program with the Douglas X-3 research aircraft.

► **American Airlines will attempt to set a new official transcontinental speed record in the transport category with its Douglas DC-7 early next year when winter winds blowing from west to east are at maximum strength. Present record is 6 hr. 17 min. set in 1949 by a Lockheed Constellation on an Eastern Air Lines delivery flight from Burbank to La Guardia Field. Recent 6 hr. 31 min. crossing of a fully loaded American DC-7 was made over the longer route between Los Angeles International Airport and New York's Idlewild. It bettered the previous unofficial record for passenger-laden transports of 6 hr. 47 min. made in 1947 by a United Air Lines DC-6.**

► Douglas DC-7s are equipped with a Mach meter as part of their airspeed indicators. Normally the DC-7 cruises at Mach .58.

► **American Airlines engineers are looking for a ducted-fan turbojet with a higher percentage of bypassed air than utilized in the current design of the Rolls-Royce Conway 11,500-lb.-thrust bypass jet. Allison Division of General Motors experimented briefly with ducted fans several years ago but there is currently no concrete activity in this field by U. S. engine builders.**

► Pan American World Airways, Aerolineas Argentinas and Colonial Airlines are investigating purchase of Douglas DC-7 transports. Currency exchange problem is the only obstacle for Argentine purchase of the DC-7.

► **Pratt & Whitney Aircraft's J57 turbojet is being considered as a powerplant for some long-range missiles.**

► Douglas A2D Skyshark made an emergency landing at Edwards AFB recently when its turboprop gearbox disintegrated, throwing the contra-rotating prop blades clear.

► **Pan American World Airways has an Air Force contract to develop experimental rocket mail delivery systems. First experiments with rocket mail were done in Germany before World War II. Pan American and Radio Corp. of America are still negotiating with USAF over contract operation of the long-range missile proving ground at Cocoa, Fla.**

► Aro, Inc. has begun testing the Hughes Aircraft Falcon air-to-air guided missile in one of the gas dynamics tunnels at the Arnold Engineering Development Center. Calibration operations on the engine test facility are scheduled for early next year with first actual engine tests booked for next March.

► **North American F-86D all-weather interceptor is the latest USAF plane to use vortex generators. These devices are employed around the flush air inlets and on the empennage to avoid turbulent airflow. Boeing B-47 also uses vortex generators on its wings.**

► Republic's F-103 will be used primarily as a research aircraft aimed at exploring the speed range up to Mach 3. Data obtained from the F-103 program will be used to develop a tactical aircraft with this speed capability. Materials suitable for withstanding high temperatures generated over Mach 2 will be a major problem in the F-103 research program.

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Equipment Makers Win Buying Fight

- **Major weapons subsystems to be purchased direct by USAF and furnished to prime contractors.**
- **New policy recaptures for Air Force buying authority delegated under previous single-contractor concept.**

By Robert Hotz

Avionics and aircraft component manufacturers won a major victory in their battle against the single prime contractor policy of weapons system procurement with publication of a new Air Force Regulation (70-9) that re-establishes their traditional business relationship with USAF.

The new regulation recognizes the principle of the single prime contractor policy (AVIATION WEEK Aug. 17, p. 82), but recaptures for the Air Force much of the authority formerly delegated to the weapons system contractor.

Under the former policy, largely sponsored by the Air Research and Development Command, USAF dealt with a single prime contractor for the development of a complete weapons system and gave him authority to subcontract development of all major subsystems (except propulsion) in this overall system. First and only contract of this type let to date was with Convair for development of a strategic bombing system (XB-58).

▶ **Direct Contract**—Under the new regulation, USAF will contract with a single prime contractor to develop a complete weapons system. But major subsystems—such as flight control, bombing and navigation, and armament systems—will be procured both during development and production phases by direct contract between the subsystem manufacturer and the Air Force.

The prime contractor will provide performance-type specifications for these subsystem developments which must be approved by ARDC. Equipment procured in this manner will be furnished to the prime contractor by USAF for inclusion in his complete weapons system.

▶ **Subcontract Target**—The single prime contractor policy of weapons system development has been a target of avionics and components manufacturers ever since it was first proposed by ARDC more than a year ago. These manufacturers feared it would result in creation of gigantic aircraft prime contractors who would expand to handle development and production of all subsystems.

They also objected to the prospect of contracting with prime contractors rather than directly with USAF. ARDC has been conducting an educational campaign in the aircraft industry to convince opponents that these fears are groundless, and specifically wrote into the Convair XB-58 contract clauses preventing a prime contractor from expanding to take over work normally done by other types of firms.

▶ **Affirms Concept**—The new regulation affirms USAF weapons system concept and emphasizes that procurement of future weapons be guided by this principle. It specifically assigns the areas of responsibility in weapons system development and production between Air Materiel Command and ARDC as follows:

• **AMC** will procure weapons system and subsystem development and select contractors for production of both.

AMC also is charged with maintaining close surveillance of procurability, producibility, maintainability and other logistical factors during development and production phases.

• **ARDC** is charged with maintaining close surveillance of all engineering aspects of weapons system development. ARDC also will monitor development of major subsystems to insure that development of "internal parts" is avoided when government-furnished aircraft equipment or standard USAF equipment is available or under development. ARDC also will approve all design, qualification test and installation data for all items in weapons systems and subsystems.

▶ **Procedures**—In outlining procedures to be followed by AMC and ARDC in weapons system procurement, the new regulation establishes four categories of procurement and lists them along with the types of equipment to be procured in each category as follows:

• **Category One** involves direct procurement by USAF from the weapons system contractor, and includes airframes, landing gear, wheels, brakes, tires, tubes, hydraulic actuators, pumps and valves, integral fire extinguishers, mounting and rack assemblies, oxygen equipment, external fuel tanks, radomes, navigation domes, minor electrical equipment, electric starters and electronic counter-measures (Group A).

• **Category Two** involves direct procurement during development by USAF from equipment manufacturers utilizing performance-type specifications prepared by the weapons system contractor and approved by ARDC. For production, USAF buys directly from equipment manufacturers using detailed design specifications resulting from development. Equipment in Category Two will be forwarded to weapons system contractors for inclusion in their weapons systems or issued to Air Force units in the field for use with weapons systems.

Equipment in the category includes major electric power supply equipment, non-electrical starters, propulsion systems, Rato units, constant-speed drives, airborne missile guidance systems, ground missile guidance systems, flight control systems, bombing and navigational systems, fire control systems, stabilized mountings, camera control systems, primary mission cameras and flight simulators.

• **Category Three** involves direct procurement between equipment manufacturers and USAF, utilizing specifications approved by USAF. This equipment will be provided weapons systems contractors for inclusion in their systems.

It includes navigation, flight and engine instruments, radio and radar identification equipment, radio and radar equipment when not an integral part of bombing system, radio and radar auxiliary and tie-in equipment, radio communications equipment, interphone equipment, inflight refueling gear, safety belts and harnesses, ordnance and special weapons equipment.

• **Category Four** involves procurement directly by USAF from equipment manufacturers using USAF approved specifications. This equipment is issued directly to USAF units.

It includes cameras, bomb racks and shackles, driftmeters, sextants, electronic countermeasures (Group B), flak curtains, headsets and microphones, bomb hoists and slings, cargo tie-down equipment, litters and accessory kits, flares, signals, pyrotechnic pistols, life rafts, first aid and survival kits, portable oxygen equipment, airborne test equipment, portable radio equipment, GCA ground units, ILS ground units, serv-

icing trucks and trailers, crash trucks, photographic ground equipment.

▶ **Responsibilties**—AMC and ARDC are given authority to alter the procurement procedures established in the new regulation by joint agreement after a specific review of an individual case where good reasons exist for deviation. Reasons include unique technical problems; time factor; status of other USAF developments; and the capacity and capability of particular contractors being considered.

AMC is ordered by the new regulation to include provision in all contracts with weapons system contractors providing for USAF approval of all equipment development and production accomplished directly by the prime contractor under Category One.

Responsibilities of the two commands in giving approval are defined as:

• **AMC-approval** of subcontract sources, type of subcontract, price and profit, patents and license right for equipment, timely placement of subcontracts, type and location of government-owned facilities to be used, quantity of equipment to be subcontracted and timely delivery of technical procurement and production data.

• **ARDC-selection** of type of equipment, approval of specification standardization of equipment, qualification testing of production items prior to production delivery.

In another recent regulation (20-10) USAF formally establishes the Weapons System Project Offices (AVIATION WEEK Aug. 17 p. 82) formerly called the Joint Project Offices at Wright-Patterson AFB, Ohio. The Weapons System Project Offices will be established by joint agreement between AMC and ARDC or by direction from USAF headquarters for each specific major weapons system. They are designed to serve as a single focal point for all military and contractor relations dealing with the development and production of the specific system.

The new regulation specifies that these offices will be headed by a team captain provided by ARDC during inception and early development.

▶ **First Results**—Both the new procurement regulations are the first results of the top-level USAF effort to coordinate relations between ARDC and AMC and the appointment of Lt. Gen. Orval Cook as USAF materiel czar with authority over both commands. Both regulations were in process before General Cook's appointment but their published versions reflect his position on ARDC and AMC responsibilities and the single prime contractor policy.

Further details on exactly how these new regulations will be implemented in actual practice are being worked out by a special USAF-industry committee appointed by Gen. Cook in October.

New Wing Boosts Comet 2 Lift

'Droop snoot,' planned also for Comet 3, improves takeoff performance; thrust-reverser reported near.

By Nat McKitterick
(McGraw-Hill World News)

London—A new wing to improve lift is being fitted to all Comet 2 production aircraft, and it is indicated a reverse thrust mechanism for the big transport's jet engines has moved an important step forward.

The new wing is the shape of that planned for the Comet 3.

Reverse thrust for inboard engines can be expected on the Comet 3 before these larger transports go into service in 1956. The mechanism probably will not be ready before the Series 3 prototype flies for the first time next June or July.

(Editor's Note: Frank H. M. Lloyd, DH manager of commercial sales, told an AVIATION WEEK representative in Paris Nov. 26 that the company is working on reverse thrust, "but this won't be ready for Comet 3." He said DH also expects to have emergency drogue chutes on this Model 3. Lloyd also said they have restarted the Comet's engines all the way to 40,000 ft. in flight. The DH official said the revised wing reduces stall speed, results in approximately 11% reduction in landing run. "It's now impossible to stall Model 2 on the ground," he added.)

▶ **Thrust Reverse**—De Havilland Aircraft Co. has guarded its research into reverse thrust problems with vigilence, but AVIATION WEEK learned from unimpeachable sources last week that developments are not far from the inflight test stage.

Those who have seen the mechanism describe it as a simple stovepipe affair, mounted around tailpipes of the Comet 3's two inboard Avon jets. Lever in the cockpit allows pilot to extend stovepipe mechanically, which results in diverting the jet stream through 180 deg.

It is emphasized that the mechanism will work only on two inboard jets. Possible explanation for this might be the need to preheat the stovepipe before actuating it.

This might be practical only on inboard engines.

▶ **Important Advantage**—But British officials point out that by mounting the reverse thrust mechanism on two inboard jets, close to the fuselage, one important advantage is achieved: Should one stovepipe fail to operate, the danger of disastrous complications would be minimized.

Implication is that such a device mounted on an engine pod outboard on a thick swept wing would be of dubious safety. In such case, failure of one mechanism while actuating the other would set up tremendous torque on the whole aircraft.

Air Registration Board probably will use this argument as further evidence of suitability of buried engines in civil jet transports (AVIATION WEEK Sept. 28, p. 19).

▶ **Droop Snoot**—As reported earlier (AVIATION WEEK June 15, p. 11), the wing proposed for the Comet 3 is designed to give a greater coefficient of lift without hampering cruising performance.

This is done by altering the leading edge of the basic Comet wing design by creating what is, in effect, a slight droop snoot.

▶ **Crash Result**—Decision to adopt this wing for all Comet 2 production types and the Comet 3 came as a direct result of the Comet 2 crashes at Rome in October 1952 and at Karachi in May of this year.

Both these mishaps illustrated that under certain conditions of temperature and weight (high in both cases), it is all too easy for Comet pilots to stall on takeoff when not following recommended procedure to the letter. Both at Rome and Karachi the pilots' angle of attack on takeoff created enough drag

Comet Backlog

London—New firm contracts for de Havilland Aircraft Co.'s jet transports have increased the number of Comet 3s on order to 10 and raised the Series 2 total to 34. Twenty-one Comet 1s and 1As are in operation today.

British Overseas Airways Corp. ordered five 58-passenger Comet 3s and hopes to take delivery on the first in 1956. Other contracts: Pan American World Airways, three, with an option on an additional seven; Air India, two.

Canadian Pacific Airlines contracted for three Comet 2s (AVIATION WEEK Nov. 30, p. 69) and took an option on a fourth. BOAC has 12 Series 2 transports on order, with the first scheduled for delivery early next year

Other carriers with firm contracts for Comet 2s include: Air France, Union Aeromaritime de Transport (UAT) and Japan Air Lines.

to prevent the aircraft from becoming airborne.

Immediately after the Karachi crash, Comet operating manual was changed to require pilots to keep their nosewheels on the ground until unstick speed had been built up.

For Comet 1 operations, this has proved adequate protection. But for heavier Comet 2 (maximum overall weight: 120,000 lb.) there was some question that additional weight limitations would be necessary to remove fully the danger of a recurrence of the Rome and Karachi incidents.

▶ **Takeoff Problem Solved**—The new wing will solve this problem and allow the Comet 2 to operate up to its maximum weight in all conditions.

De Havilland will not release figures to illustrate advantages of the new wing, but ARB has seen the wing in action on a Comet 2 prototype and claims the takeoff problem has been solved. Present operating procedure will be kept, even with the new wing.

▶ **Engine Performance**—De Havilland claims that the new wing will not affect cruising speed.

Engine intakes for the Comet 2's four 6,500-lb.-thrust Rolls-Royce Avon R.A. 9 jets will be affected only slightly by the new configuration.

But the present 6,500-lb. rating of the R.A. 9 is slated to increase up to 7,200 lb., improving cruise and takeoff.

▶ **Stall Speeds**—The new wing by nature will ease slightly the second major problem of civil jet operations—landing speeds. As the Comets get heavier, stall speed on landing becomes a more urgent requirement.

The Comet 2's stall speed at maximum landing weight is said to be greater than that of the Series 1, the latter being about 105 mph. The new wing will narrow the gap.

But the new wing is by no means going to solve all landing problems of the de Havilland transports—especially those of the heavier Comet 3 (allup weight 145,000 lb.)

Ultimately, both U.S. and British manufacturers agree, some mechanism to reverse the thrust of a jet will be needed to allow heavy jet transports to land on most of the world's runways.

▶ **Bridging the Gap**—If the new Comet wing and the reverse thrust mechanism are as successful as the British contend, they will go along way toward bridging the gap between ARB and Civil Aeronautics Administration over certification of the Series 3.

Problems of takeoff and stalling are high on the list of subjects on which CAA jet evaluator George Haldeman has said he wants more information.

Correspondence between CAA and ARB has started again, looking toward a new visit by Haldeman next spring to see the new Comet 2 wing in action.

More Titanium a 'Must': Talbott

USAF's chief calls for immediate action to increase production of the metal, anticipates support from Wilson.

By Katherine Johnsen

Air Force Secretary Harold Talbott has added momentum to a determined drive by government and industry to expand the U.S. titanium capacity vastly and rapidly.

He described titanium as a "must" for superior air power in the future and called for vigorous and immediate action to increase production. Talbott anticipated that Defense Secretary Charles Wilson would support his position.

"We are woefully weak in producing 2,000 tons a year," Talbott told the Senate's Strategic Metals Subcommittee, headed by Sen. George Malone.

▶ **Vast Gap**—Reopened hearing in the capital added new testimony on the vast gap between titanium supply and demand to the subcommittee's record, developed at previous hearings at which Air Force and West Coast aircraft manufacturers appeared (AVIATION WEEK Oct. 26, p. 14; Nov. 23, p. 22).

• **Roy Hurley**, board chairman of Curtiss-Wright Corp., estimated that if titanium were freely available his firm could use 36,000 tons annually by 1956 in the commercial and military engines it expects to build.

This would require a titanium sponge output of 108,000 tons, allowing for waste in processing and manufacture. The most optimistic expectation of sponge output by 1956 under present plans is 13,200 tons.

• **William O'Donnell**, chief development engineer for Republic Aviation Corp. emphasized that titanium is essential for highspeed fighter aircraft and guided missiles now approaching production.

• **Leo M. Harvey**, president of Harvey Machine Co., reported that a private survey indicated that by 1955 aircraft engine manufacturers could use 50,000 tons of titanium annually and an additional 50,000 tons each successive year until a minimum requirement of 250,000 tons a year is reached.

He said airframe manufacturers have indicated a similar requirement eventually, bringing the total to 500,000 tons a year.

▶ **Urgent Program**—Here are recent developments that indicate the urgency of the titanium production expansion program:

• **New survey.** Air Force and the Office of the Assistant Secretary of Defense for Supply and Logistics, headed by Charles Thomas, are launching a new review that is expected to result in a major increase in Defense Department's official titanium requirement, set two years ago at 35,000 tons annually by 1956.

• **Pressure on ODM.** The new requirement study will bring heavy pressure on Office of Defense Mobilization to raise the ceiling of 25,000 tons a year as the titanium expansion goal. ODM at first cut Defense Department's 35,000-tons-a-year recommendation to 22,500 but increased it this summer to 25,000 tons.

The Malone subcommittee plans to confront ODM chief Arthur Flemming with the testimony of the aircraft industry on requirements at a hearing in the near future.

General Services Administration's chief, Edmund F. Mansure, has assured the Senate subcommittee that he will take prompt steps to contract for the full 25,000-ton expansion authorized by ODM.

So far, GSA has contracted for only 12,300 tons a year: 6,000 with Crane Co., 3,600 with Titanium Metals Corp., and 2,700 tons with du Pont de Nemours Corp. In private facilities, du Pont is producing 900 tons a year. This would bring the optimum 1956 output to 13,200 tons.

• **New expansion.** Producers are ready to expand with government assistance. National Research Corp. and Monsanto Chemical Co. reported they have a proposal for a 6,000-tons-a-year facility using a new, jointly developed process pending before GSA.

Horizons, Inc., is ready to construct a pilot plant to test one of two processes it has developed.

Electro-Metallargical Co., a subsidiary of Union Carbide and Carbon Corp., will put up corporation money to construct a 10,000-tons-a-year facility, with assurance of government purchase of production. Titanium Metals is another candidate for further expansion.

DuPont, however, is doubtful. "I feel that from an economic point of view we should not expand at the present time but should devote our efforts to the development of processes having inherently greater promise of providing titanium at prices more nearly commensurate with the long-range requirements of the military and civilian fields," du Pont's Dr. E. A. Gee testified.

▶ **Poor Quality**—Improvement of the quality of titanium poses a problem matching that of boosting output for the military and industry.

Aircraft and engine manufacturers estimate that a Brinell hardness rating

of 140 to 150 maximum on titanium alloys is required.

The hardness rating stipulated in the Titanium Metals contract, first to be executed, was 225 Brinell, and much of the firm's production has been wasted because of poor quality. As a result, instead of reaching its capacity output of 3,600 tons a year in September 1952, as the contract called for, the firm is not expected to reach this rate until next mid-year.

▶ **Increasing Difficulties**—Meanwhile, aircraft and engine manufacturers can expect increasing difficulties in obtaining titanium:

• **One aircraft engine program alone** will use up about three-fourths of the 1956 output of titanium of 13,200 tons. William Gwinn, general manager of Pratt & Whitney Aircraft, estimates his company would require 6,000 tons for the J57 program and that its licensee, Ford Motor Co., would require about 3,000 tons.

• **Titanium allocation program** is on a voluntary basis. An allocation is no more than a license to buy. As competition for the metal increases, manufacturers, even those with allocations, appear headed for difficulties.

• **From the long-range view,** Army and Navy, as well as the air arms, promise to become heavy users of titanium—adding to the competition for the metal.

R&D Chief Outlines Research Policy

The Defense Department has taken no steps to de-emphasize basic research but will restrict its support to those fields with a high probability of producing results for military needs, says Donald A. Quarles, Assistant Secretary of Defense for Research and Development.

Certain basic research "of marginal relevance to the Defense mission" will be shifted to the National Science Foundation, Quarles told the Stanford Research Institute at San Francisco.

Quarles says the military will spend approximately $1.3 billion this year on 8,000 separate research and development programs, approximately two-and-a-half times the annual amount spent prior to the Korean War.

▶ **Method of Operation**—In decentralizing Defense R&D activities (AVIATION WEEK Oct. 26, p. 9), Quarles reports that each of the three services will be held individually responsible for seeing that its own programs are:

• **Realistic,** relative to the state of the art and the chances of success.

• **Sound** in relation to respective needs and to programs of other military services.

▶ **Coordinating Committees**—More than a dozen coordinating committees, one for each major field of activity, will plan and coordinate the R&D programs, Quarles says. Each will consist of representatives from the services involved and from Quarles' office.

"If (the committees) arrive at unanimous views, they will be accepted," he adds. "If there is a dissent, including a dissent by the Department of Defense representative, I will have to . . . resolve the matter for the Secretary of Defense."

One or more panels of civilian scientists will be formed to serve as consultants to each coordinating committee. These panels will resemble previous R&D Board groups in make-up but will function only in an advisory capacity. Quarles asks that private research groups, like SRI, and industry cooperate by making experts available.

Aviation Needs New Sales Effort: Ashman

The advent of a buyer's market in aviation following a 20-year seller's market makes it vitally necessary that the industry rebuild a strong sales management team, says J. E. Ashman, president of Air Associates, Inc., Teterboro, N. J. "There is no easy bromide or quick way out for revitalizing sales effort," he told the 11th annual meeting of Aviation Distributors & Manufacturer's Assn. at St. Louis.

▶ **Business Hypnosis**—Ashman blamed the long-term seller's market for inducing a "state of hypnosis" in business and cited the one-customer company's habit of changing the sales manager's title to "contract coordinator."

Ashman said time and training are the only means of obtaining effective results in rebuilding a sales organization, describing advertising and other promotion techniques as valuable tools, not panaceas.

▶ **New Officers**—At the closing session of the meeting, delegates elected as president Lawrence F. Zygmunt of General Aircraft Supply Corp., Detroit. James Riddle of National Aeronautical Corp., Ambler, Pa., and R. S. Northington, Piedmont Aviation, Inc., Winston-Salem, N. C., were named vice presidents.

LEDUC 021, predecessor to France's 022 ramjet, with designer Rene Leduc (center).

Mach 2 Forecast for Leduc 022

(McGraw-Hill World News)

Paris—French aircraft designer Rene Leduc says he expects his first supersonic ramjet to fly in 1955 and predicts it will attain a speed of Mach 2 in level flight.

The Leduc 022 now is under construction while flight testing continues with the 021 (AVIATION WEEK June 29, p. 9), last in a series of experimental subsonic ramjets sponsored by the French Air Ministry for development of a supersonic design.

▶ **24,000 Hp.**—Leduc says the 021 develops the equivalent of 24,000 hp. and has a low-level climbing rate of 39,370 ft. per min. at Mach .84. At 45,000 ft., its rate of climb is 4,000 to 5,000 fpm.

He says the Leduc 022 will develop power equivalent to a thrust of 60 tons. It will have sweptback wings and will climb faster than the Leduc 021. To achieve the necessary power in the 022, the designer says fuel will be burned at a maximum rate of 11,000 gal. an hour.

▶ **Tricky Problem**—Designing a lightweight fuel pump with the necessary power was one of the trickiest problems he had yet encountered in building the supersonic plane, Leduc says. The fuel pump in the 022 will weigh 20 lb., compared with nearly a ton for an industrial pump of similar power and capacity.

Leduc's work on ramjets is carried out with the financial backing and supervision of the French air ministry and is under tight security wraps.

High-Density Minimums

IATA's recent air traffic conferences set the following minimum seating densities for air tourist service:

Breguet	107	Argonaut	54
Bretagne 5030	40	DC-6	60
Boeing 377	81	DC-6B	77
Constellation (up to 749A)	58*	Elizabethan	47
Constellation 1049	78	Languedoc	44
Convair 240	40	Sandringham	30
Convair 340	48*	Scandia	32
C-46	31	Viscount	47
DC-3	21	Viking	36
DC-4	55	Wayfarer	40
DC-4M	44		

*In North-South America and nearby islands Constellation seating minimum is 61, and Convair 340 is 44.

IATA Approves Global Aircoach

Member airlines pave way for trans-Pacific tourist flights and high-density service across mid-Atlantic.

Worldwide aircoach service now is assured as a result of International Air Transport Assn.'s traffic conferences at Honolulu. Agreements were enacted by the 70 member airlines to stretch coach service across the last non-tourist link, the Pacific.

Major features of the air tourist and other agreements:

- **Addition** of tourist service over the mid-Atlantic.
- **Readjustment** of coach and first-class fares.
- **Determination** of conditions to differentiate tourist from first-class service.
- **Standardization** of baggage allowances on world air routes.
- **Initiation** of new quantity discounts on scheduled air-cargo service in some parts of the world.

The trans-Pacific agreement set Apr. 1 as the start of tourist service across all three of Pacific routes. These are between North America, Australia and New Zealand; Malaya, Siam, Hong Kong and the Philippines; and Japan and Korea.

Tourist fares on the three routes will run about 25% below present first-class rates.

▶ **$1,100 Fare**—Provided the governments concerned approve the IATA agreements, an air passenger will be able to fly around the world on tourist service for about $1,100. First-class fare now is about $1,700.

Tourist service over mid-Atlantic routes will begin Oct. 1, 1954. At that time first-class fares will be adjusted upwards and tourist rates set at between 15% and 20% less.

First-class fares between Europe and South America over the South Atlantic will increase about 7% because of currency fluctuations.

On the North Atlantic route, IATA voted to narrow the difference between the two services. Slight increases in both tourist and first-class will be necessary to meet rising costs. For example, the basic North Atlantic fare between London and New York will be $400 one-way and $720 roundtrip. At present, the first-class fares are $395 and $711.

Tourist fares will be $290 one-way and $522 roundtrip, compared with $275 and $495 at present. Off-season roundtrip fares—from Nov. 1 through Mar. 31—will be $640 first-class and $425 tourist, as against the current $611 and $425.

▶ **Special Services**—In addition to the expansion of the air tourist network, the conferences agreed on special coach services among Northern England, Scotland and Scandinavia. This permits further reductions of 10% below tourist rates in the 28-passenger DC-3.

On the Europe-Africa rates, slight increases were agreed upon for both services with the differential remaining at 15% to 20%. Europe-Middle East fares will rise about 1%, with an 18% difference between the two rates.

Increases ranging from 3% to 10% also will be made on Europe-India and Europe-Far East routes.

▶ **Barrier Doors**—Mixed-class aircraft will be used by about 15 airlines, the IATA conferences brought out.

However, to prevent abuses that might result from carrying two kinds of traffic in the same plane, bulkheads must be erected between tourist and first-class compartments. Each barrier will be fitted with doors which can be latched.

The mixed-aircraft resolution is subject to review in a year.

▶ **Solving Problems**—Alcoholic beverages will not be sold on tourist flights in the Western Hemisphere or across the Pacific. Elsewhere, they will be sold only at certain specified minimum prices.

IATA also threshed out the baggage allowance problem, standardizing it at 44 lb. for tourists and 66 lb. for first-class. Excess baggage, under the new system, will be charged at a straight 1% of the one-way adult fare.

International air cargo rates will remain generally the same. Between Europe and the Middle East, Far East, Africa and South America, rates will be increased 5%. A new bulk discount of 30% for shipments of more than 440 lb. will be allowed on trans-Atlantic and North and Central Pacific routes.

Budget Forces CAA Safety Realignment

Budget officers last week revealed more details of the three major moves being made by Civil Aeronautics Administration to pare its fiscal year 1954 budget. They are:

- **Realignment** of the Office of Aviation Safety.
- **Elimination** of 35 interstate aeronautical communications stations.
- **Elimination** of some 500 auxiliary power generators.

CAA Administrator Fred B. Lee has ordered his budget staff to work out final details of the cutbacks before Jan. 1 in order to save as many appropriated dollars as possible in the remaining six months of the fiscal year which ends June 30.

CAA will reshuffle its aviation safety program by realigning its authority and responsibilities. This will save $775,000 a year. Basic organizational relationships within the regions and between the regions and the Washington office will not be affected.

▶ **Delegate Authority**—Area supervisors will be responsible for final action in performance of the air carrier safety work program. Each supervisor will delegate safety agents to act in the receipt, review, approval, issuance, amendment, renewal and reissuance of all certificates, operations specifications, designations, waivers, permits and other documents which have to be approved or issued by CAA.

These safety agents also will be responsible for conducting or arranging for the conduct of all inspections, reviews, investigations, proving flights, negotiations and liaison for the area supervisor.

Under the new setup, CAA expects to provide faster service to air carriers, since problems can be handled by field office personnel, such as the agents, rather than referring them to the re-

gional office as before–a much slower process.

▶ **'Maximum Use'**–Effort will be made, said A. S. Koch, OAS director, to make the "maximum use" of all agents. Indoctrination of agents and work assignments at the field level, planned programs at regional headquarters and assignments to the aeronautical center and to industry and government training courses where available are planned.

Current plans of the safety office may entail redistribution of employes among regions and between the four regions and the Washington office.

Studies are continuing to determine which 35 of the 452 interstate aeronautical communications stations will be eliminated or consolidated (AVIATION WEEK Nov. 23, p. 18). This cut is expected to save CAA $1,107,000 a year. Emphasis is being placed on maintaining a communications status quo for the airline, military and private users of the stations in the interests of safety. Each of the three types of air traffic use about a third of CAA's airways service, a recent user-charge study indicated.

▶ **Location Factor**–Big factor in the determination is the location of the station as it affects main trunk routes or particular natural hazards, such as mountains. The area covered by the station is another factor, since proximity to other available stations is important. The station's activity also is considered.

The stations affected by the cutback will not be dropped at once but phased out within the next six months.

Some 500 of the 1,260 auxiliary power generators will be shut down Jan. 1. That choice will depend upon the availability of a secondary source of power. None of the emergency gasoline generators will be removed unless there are two dependable sources of power available to any CAA installation throughout the country. That cutback will save CAA $360,000.

In addition to the photo lab shutdown in CAA's Washington headquarters (AVIATION WEEK Nov. 16, p. 14), the agency also will discontinue operations of its airplane model shop.

Multi-Engine Business Plane Service Booms

Maintenance of multi-engine business aircraft by Grand Central Aircraft Co., Glendale, Calif., is running at an all-time high, the company reports, and scheduling of workloads to handle next year's backlog has been started early this year.

Approximately 100 large business planes have been serviced by Grand Central during 1953, president O. D. Denny reports.

AIA Updates Aviation Statistics

Modley's 1953 compilation of industry facts and figures is based on information from hundreds of sources.

Latest available facts on the aviation industry taken from hundreds of sources are included in a new compilation to be published this month by Aircraft Industries Assn.

Although not an original research, the book–Aviation Facts and Figures 1953–is a complete resume, within bounds of security, of the aviation industry since its beginning.

The editors, aviation consultant Rudolf Modley and statistician Thomas J. Cawley, found a second limitation in addition to security: lack of comparability because of different meanings attached to such terms as "aviation," the "aeronautic industry," the "aircraft industry," etc.

By and large, however, the AIA book –an updating issue by the same editors of previous similar volumes published by McGraw-Hill Book Co.–is an important adjunct to the aviation library. Publisher this year is Lincoln Press, Inc.

Some pertinent facts from the volume:

▶ **Facilities:**

• Since Korea, floor space of airframe facilities had doubled, engine facilities tripled.

• Cost of aircraft, engine and accessory facilities expansion in World War II and in Korean war was almost equal–$3.9 billion 1940-1945, $3.5 billion 1950-1953.

• In World War II, only $420 million was privately financed facility expansion; in Korean war, $1,200 million was privately financed.

• In World War II expansion, 40% went into buildings, 60% into equipment. During Korea, 30% went into buildings, 70% into equipment.

• Largest aircraft, engine, accessory facilities expansion during 1950-53: General Motors, $231 million; United Aircraft, $99.5 million; General Electric, $91.6 million; Ford Motor Co., $50.8 million.

• In World War II, 50% of facilities expansion was for aircraft engines, 7% for equipment and parts. During the Korean war, engine facilities increased to 58%, equipment to 19%. Airframe and propeller facilities expansion decreased correspondingly in importance.

• Connecticut and California, which had only 10% of the World War II expansion, had more than 20% of the Korean war expansion.

▶ **Production:**

• In the last 20 years the value of aircraft production grew from $26.5 million to $9.3 billion per year–or about 350 times. This means that the industry now produces in one day what it produced in a whole year in 1933.

• The "cold war" increase in aircraft production was not made at the expense of civil production. The value of military production grew five-and-a-half times, 1948 to 1952. But civil production grew almost four-fold in the same time.

• AIA estimates 1953 production as 12,000 military aircraft weighing 140 million lb. of airframe weight and 4,700 civil aircraft weighing 11 million lb.

• Of the 16 companies which delivered more than 25 aircraft during World War I, not a single one is in existence today under the same name.

• By 1951, the aircraft and parts industry consumed 17.6% of all the aluminum consumed by the metal-working industries. At present the total may be as high as 25%.

▶ **Labor:**

• At present, employment in the aircraft, engine and parts industry is about equal on the West and East Coast, with 30% each.

• Employment is leveling off but still is on the increase. The peak appears to be around 750,000.

• The Korean expansion took place with rather little use of overtime. Peak of weekly hours was reached during 1951, with 44.1 hr. for the entire industry in April and December. Only propeller workers went up, to 48.1 hr. in July of that year.

• Average weekly earnings in 1914 were less than $16 for an airframe worker. In the summer of 1953 they were about $80.

• Employment of women today is only 18%, one-half of the World War II peak.

• While accessions in the airframe industry still exceed separations, layoffs are up sharply–from 4 per 10,000 workers per month in 1951 and 23 in 1952 to 53 in early 1953.

• Two-thirds of all airframe workers are members of the International Association of Machinists, one-third are in the CIO-UAW. On the other hand, more engine workers are in the CIO-UAW than are in the IAM.

• The aircraft manufacturing industry is one of the safest industries to work in. There were only 3.7 disabling work injuries in 1952 for every million hours worked, compared with a total of 14.3 in all manufacturing. Injury frequency rates in the aircraft industry have dropped from 15.8 in 1940 to 3.7 in 1952, while the rates for all manufac-

turing have stayed almost unchanged.

▶ **Finance:**

• With an increase of working capital of only $20 million from 1950-52, the 12 major airframe manufacturers were able to finance a $575-million increase in accounts receivable and inventory.

• Working capital turnover was increased from 4.8 times per year in 1950 to 12.1 times in 1952.

• During the 23 years for which reports are available, the number of corporations producing aircraft and parts which lost money is almost equal to the number which made money.

• From 1937 to 1952 the 12 major airframe manufacturers paid net federal taxes of $1.4 billion. Their net profit was $537 million.

• In the 12 years from 1941 to 1952, only once was the aircraft industry profit rate higher than that of all manufacturing industries in 1941. In eight of the 12 years, it was less than one-half of the rate of all manufacturing industries.

▶ **Military Aviation:**

• About 10 cents of every dollar's worth of goods and services which this country produces goes to military aviation.

• In fiscal year 1953, we spent about $22.5 million per day for aircraft and related procurement. This is almost as much as we spent during the entire year 1933.

• We lost 2,247 aircraft in the Korean war, but claim only 1,118 enemy aircraft destroyed.

• The average airframe weight of Air Force planes accepted during 1952 was 12,600 lb., that of Navy planes, 8,400 lb.

▶ **Airlines:**

• This is the time and the cost for a passenger to go from Pittsburgh to Philadelphia: 1812, stagecoach, 6 days, $27; 1834, rail, canal, and stage, 4 days, $15; 1953, train-coach, 6 hr., $11.81; 1953, train-parlor car, 6 hr., $18.25; 1953 airplane, 1½ hr., $16.75.

• As of June 30, 1953, the airlines owned about 1,500 airplanes valued at $460 million.

• In the year ended June 30, 1953, the nonskeds flew as many revenue passenger miles as the domestic trunklines flew in 1939.

• Cargo carried by aircraft has grown nearly 15-fold since 1945. In spite of all-cargo and irregular carriers' competition, the airlines' express and freight business has grown seven-fold.

• Mail, which contributed 37% of the operating income of domestic scheduled airlines in 1938, contributed only 7.2% in 1952.

▶ **Helicopters:**

• Approximately 3,000 helicopters have been produced in the last seven years.

• Current helicopter industry employment is about 14,000. Six manufacturers are in active production on 15 models.

▶ **Utility Aircraft:**

• Utility aircraft production will reach 4,000 planes in 1953, highest production since 1949.

• A four-seater airplane can be flown at 1.7 cents per seat-mile if used 500 hr. per year.

▶ **Exports:**

• Since 1950, more than 4,000 military aircraft have been shipped overseas to our allies.

• Value of aeronautic exports, Military Defense Assistance and other shipments will approximate $900 million in 1953.

• From 1948 to 1952, the U.S. exported 241 new passenger transports valued at $131.4 million and 3,208 utility aircraft which were valued at $18.5 million.

▶ **Foreign Aviation:**

• In 1952, airlines of the world flew more than a billion miles, carried 45 million passengers nearly 25 billion passenger-miles.

• British exports in 1952 were valued at $121.6 million, compared with $603.2 million U.S. exports. But British exports make up a very much larger percentage of value of total production of the country.

• In 1952, Canada exported $32.7 million worth of aeronautic products into the U. S.—the first time such exports were significant since World War II.

▶ **Miscellaneous:**

• Airport investment in the U.S. is $10 billion—$6 billion has been spent for military airports, $4 billion for civil airports.

• In fiscal 1953, 1,701 Navy and Marine pilots got their wings. Air Force does not disclose its output of pilots.

• In 1953, 24,000 engineers will graduate in the U.S. In the Soviet Union the number of graduates will be 32,000.

HUREL-DUBOIS 31, prototype of H.D. 32 fleet ordered by Air France to replace DC-3.

Air France Orders H.D. 32 Fleet

(McGraw-Hill World News)

Paris—Air France has ordered 24 Hurel-Dubois 32 twin-engine transports, the airline announced last week.

This is the largest number of planes Air France has ordered from any French builder, and it is the first placed for the H.D. 32. Hurel-Dubois expects the order to be followed by contracts from other carriers, both French and foreign. The builder hopes to bring orders for the high-aspect-ratio wing transport to 150.

Deliveries to Air France are scheduled to begin within two years. The H.D. 32, successor to the prototype H.D. 31, will be used as a DC-3 replacement on French and French Union lines.

First prototype of the 32 is nearing completion and is expected to make its initial flight before year's end. Testing will be brief because the design (AVIATION WEEK Apr. 20, p. 40) already has been proved thoroughly in the H.D. 31, which is almost exactly the same plane except the 32 has more powerful engines—a pair of 1,200-hp. Pratt & Whitney R1830s against 800-hp. Wright Cyclone C7BA1 in the H.D. 31.

The H.D. 31 made its first flight last Jan. 27.

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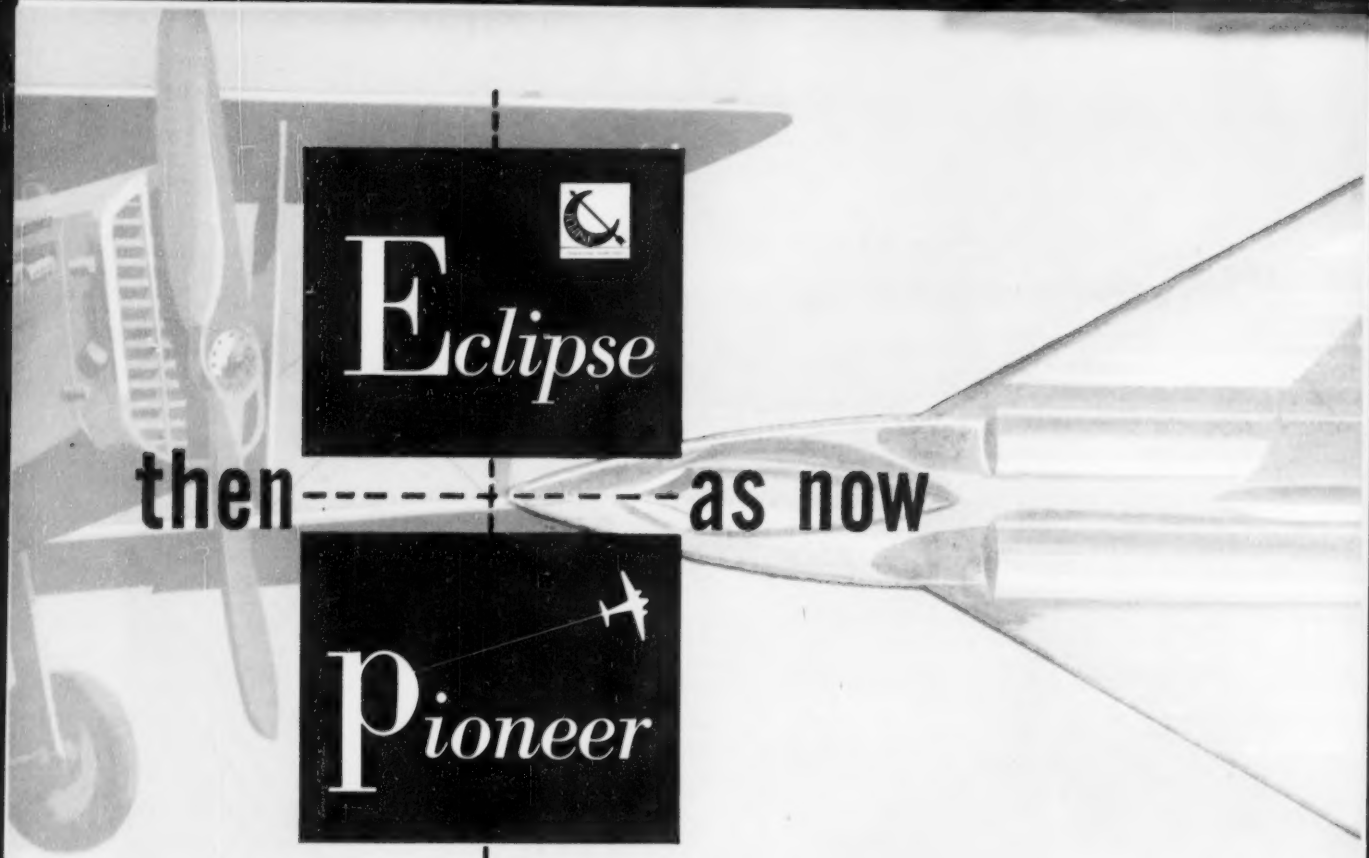

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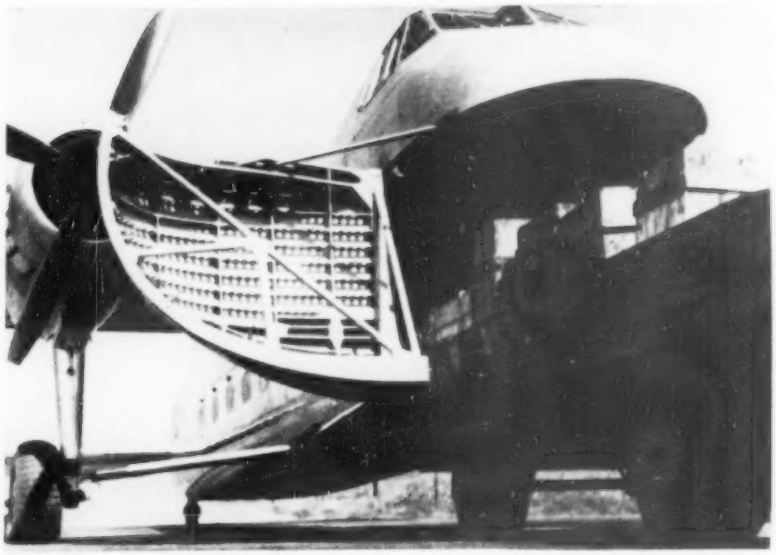

LARGER CARGO PLANES like Bristol Freighter will spark airfreight expansion.

Air Brokers Mate Planes, Cargo

Baltic Air Exchange in Britain speeds freight shipment by bringing together the carriers and the shippers.

London—A modern development of a 200-year-old British institution serves as a marriage broker to bring together on the one hand scheduled airlines and charter aircraft operators, and on the other shippers of cargo and organizers of parties of passengers.

The modern development is the Baltic Air Exchange, and it meets between noon and 1 p. m. on the floor of the Baltic Exchange, which has been arranging ship charters and the shipment of merchandise for two centuries now.

▶ **Speed to Sell**—Speed is a key factor in the operation of the air exchange. In one case a passenger was aloft 30 minutes after he had approached the broker. In another, a cargo of machinery was on its way overseas within four hours.

The air exchange was organized in 1947, although plans for an air section in the Baltic Exchange had been discussed before World War II. In 1949, the Airbrokers' Assn. was formed to promote use of the air exchange.

Represented on the market are some 50 of the principal United Kingdom and foreign owners, including British Overseas Aircraft Corp., British European Airways, Sabena Belgian Airlines, KLM Royal Dutch Airlines, Air France and Air India.

Much of the commercial chartering of British independent companies is done through the Airbrokers' Assn. The members feel that business now is limited only by the shortage of suitable long-distance, high-capacity freighters. As new cargo craft go into operation, the brokers expect costs to drop spectacularly.

▶ **Global Service**—Even now, members of the air exchange believe that their worldwide contacts enable them to keep charter costs to a minimum. This is a result of their ability to dig up freight shipments for return trips, so only 40% of the charter flights come back with empty holds.

Despite the name "Baltic," the exchange is far from regional. Much of the work it originates is in countries remote from Europe, involving foreign aircraft plying routes that never touch on England at all.

Charter flights are not always merely "out-and-back" affairs. Not long ago, one independent United Kingdom company set up a long-distance operation comprising a number of continuous though separate charters totaling over 31,000 miles, to Japan via India, thence to South America, back-tracking through India and North and West Africa with a variety of cargoes and passengers. It lasted four weeks and went through without a hitch. The same company has since carried out, with a York, a journey of some 34,000 miles.

▶ **New Routes**—Until quite recently, the most rapidly growing type of business—somewhat naturally in view of the shipping connections of the Baltic Exchange—had been in the carriage of seamen and ships' spares. Now, however, increasing interest is being taken

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in general cargo, and many inquiries are being made by exporters.

Also, independent operators can now apply to operate new routes. More than 100 such applications have been sent to the Air Transport Advisory Council by these companies, including a number for overseas routes. Operators will be granted licenses to maintain scheduled services for seven to 10 years, thus enabling them to plan ahead with confidence and to attract badly needed additional capital to the industry.

▶ **Big, and Growing**—The independent operators are already making a sizeable contribution to the total capacity of Britain's merchant air service. As the new and larger aircraft come into commission, they expect to broaden their activities, particularly in new areas and difficult territories.

Growth of the freight volume carried by Britain's airlines has been dramatic. On international scheduled services, operating to a regular timetable, cargo has multiplied threefold in the past three years. Passenger traffic has gone up 84% in the same period. Freight charters have added considerably to this volume, and the traffic carried by members of the British Independent Air Transport Assn. went up 100% in the last year.

British European Airways carried 19% more freight last year than the year before.

In their last financial year, British Overseas Airways Corp. carried an average of over 16½ tons of freight every day, representing a rise of nearly 150% over the total of three years before. In addition to cargo carried in the freight holds of their passenger aircraft, the corporation operates regular freight services between London and Singapore with stripped York aircraft, carrying bulky cargoes such as machinery and propellers.

▶ **Channel Jumping**—Britain's cross-Channel air ferry service is working very satisfactorily. A task recently undertaken was the movement of 2,000 head of cattle to the Continent, perhaps the biggest aerial movement of cattle to date.

Another large-scale job was the removal of the office equipment and furniture from the 200-room headquarters of the North Atlantic Treaty Organization in London to its new home in Paris. This movement of cumbrous equipment weighing over nine tons was completed in four days. An interesting point is that this air operation was not expensive; it raised the overall cost only slightly, due to the substantial economy effected in packing and insurance.

▶ **Aid to Exporters**—Britain's exporters, who today are among the most air-minded in the world, are being backed up by airfreight facilities that enable them to build up new overseas business. Samples can be flown out to individual markets in a few days, and an efficient spares and replacement service guaranteed in remote areas. Firms can follow up their own foreign sales efforts quickly and intelligently.

In a recent instance, demand created for a certain type of engine filter by advertisements in Canadian newspapers was rapidly satisfied by the United Kingdom producers who flew supplies across the Atlantic.

Regularity of Britain's freight services is encouraging a new type of shopkeeping overseas. A hat shop can confidently be opened in, say, Dar-es-Salaam, Tanganyika, with only a few models, in the confidence that replacements or enlargements of stock can be obtained in a matter of days from England.

A system which is helping manufacturers to meet their delivery dates is operated over certain scheduled routes by BOAC whose cargo inquiry office holds space allotments on services so that shippers may be certain their consignments will go at specified times.

▶ **Special Rates**—For large cargoes of particular categories of goods traveling frequently to some overseas destinations, BOAC has introduced special commodity rates. Among products for North American and European markets qualifying for these rates at present are

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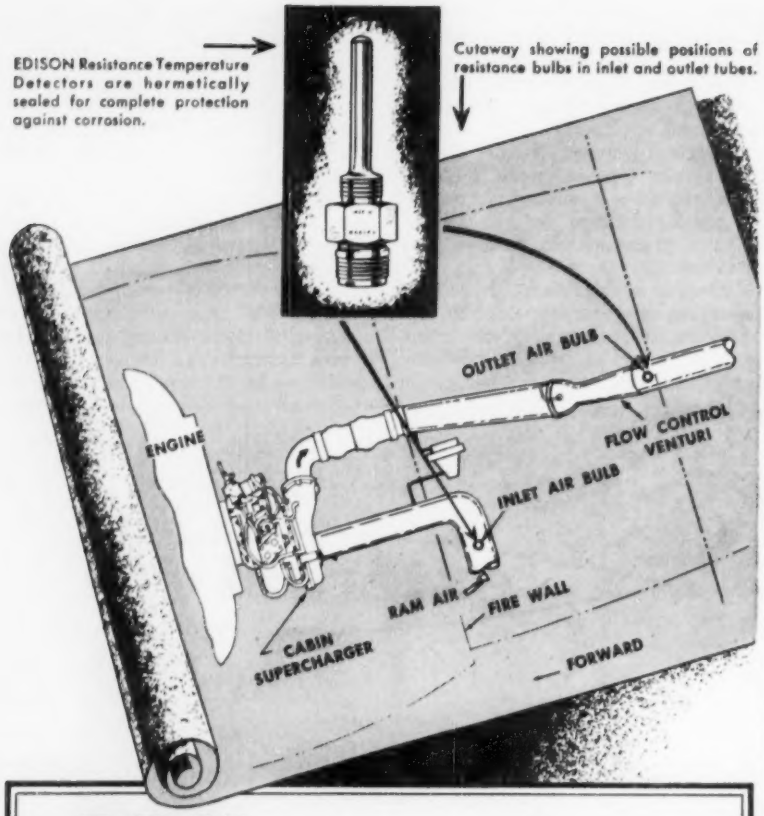
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Apart from speed, an advantage which is gaining popularity for airfreight is the simplicity—and consequent lightness—of the packaging required.

A man, wishing to export a sewing machine to Africa, brought it to the airways terminal packed in a stout wooden box. Subsequent removal of this, as unnecessary, reduced the freight bill by $8.40.

Other advantages are lower handling costs and good safety factor. Recently two separate consignments of fluorescent lighting tubes, sent by surface transport to Greece, were found on arrival to be damaged. Replacements ordered out by air arrived in perfect condition.

► **Chicks and Chocolate**—Air cargoes today range from the minute to the immense—from a day-old chick to a 12½-ton chocolate-making plant. But main emphasis is now not on unusual items but on the regular carriage of various commodities in daily demand, such as pharmaceutical products, machinery parts, car spares and wearing apparel. An exception perhaps is the transport of livestock.

Every third or fourth passenger on British Overseas Aircraft Corp. routes is an animal, bird, fish or reptile.

Expansion of this trade has produced a new building at London Airport—a hostel for animals, built by Britain's Royal Society for the Prevention of Cruelty to Animals at a cost of $56,000. It is equipped with an ambulance and mobile oxygen unit for sick arrivals.

PAA-EAL Interchange Approval Renewed

Approval of the voluntary New York-South America interchange contract between Pan American World Airways and Eastern Air Lines again has been recommended by Civil Aeronautics Board examiner Thomas Wrenn in the controversial Balboa service case.

CAB two years ago reversed Wrenn's recommendation, but Presidents Eisenhower and Truman returned the CAB opinion for Board review. The Board has favored forcing competitive combinations of Braniff Airways with Eastern and Pan American with National Airlines.

Eisenhower requested new evidence in the case. Examiner Wrenn renewed his recommendations of two years ago, finding that the new evidence does not alter his previous conclusions. Wrenn also recommended that the Board should consider a Braniff-National combination if it is voluntarily proposed.

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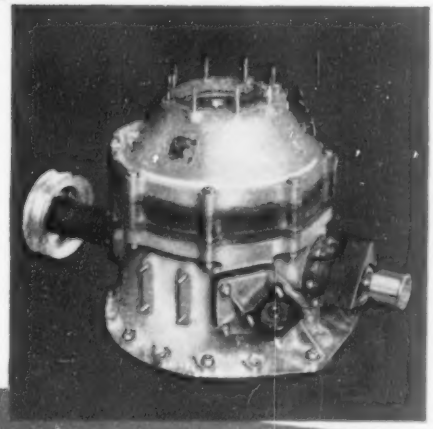

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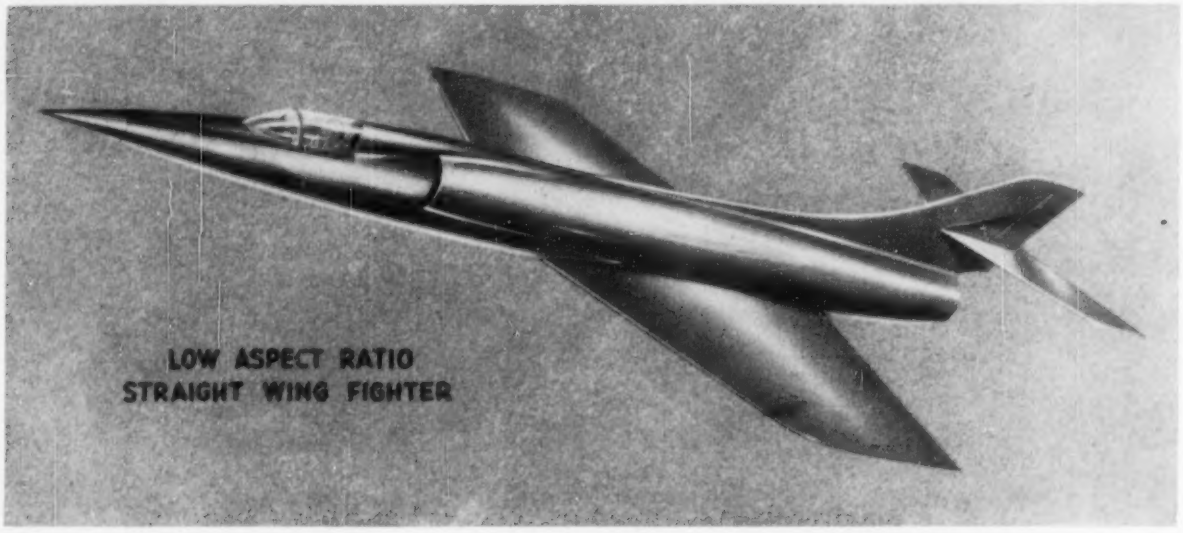

'Kelly' Johnson Looks at Deltas and Swept Designs, and Finds . . .

Thin, Straight Wings Best Up to Mach 2

Lockheed engineer says delta or swept wings do not match lift or handling features of straight foil.

"Styles are bad things in engineering," says C. L. "Kelly" Johnson, Lockheed chief engineer, who takes a dim view of the aeronautical fashion trend toward the triangular silhouette.

So he proposes a further critical evaluation of wing and tail planforms for supersonic flight. Out of his analysis comes a strong argument for the unswept thin wing of low aspect ratio, a Lockheed design trend which has been interrupted only once in recent years with the sweptwing XF-90 penetration fighter of 1949. Johnson's views were presented in a paper at the recent Society of Automotive Engineers' National Aeronautical Meeting.*

Johnson makes his design comparison on the basis of what he calls the "real estate problem." His first criterion for comparison is equal field length; he further specifies that the same mission and the same payload or equipment are additional criteria.

Then, choosing his working speed range from Mach zero to two, Johnson rides forth to conflict against the proponents of the delta and the swept wing.

▶ **First Arguments**—These are the advantages of the straight wing, says Johnson:

- **Better landing and takeoff** characteristics than either delta or swept wing.
- **Stability advantages** over the delta at high angles of attack.
- **Higher lift-drag ratio** than a comparable delta.
- **Maximum usable lift** is more than twice that of a delta, and about half again as much as that of a tailed delta.
- **Overall stability and control** is superior to other planforms.

The major problem with the straight thin wing will be one of flutter and aero-elastic effects, says Johnson. Stability at high speed will be about the same as the delta, and will no doubt call for artificial stability devices; and because the buffet characteristics of thin wings at high lift are largely unknown, "we may have to accept some transonic buffeting."

▶ **Lockheed Study**—Most of Johnson's ammunition was furnished by the results of a fighter design study Lockheed made in 1947.

The final configuration was a twin-tailed delta; it was discarded as a design after a drag evaluation through the transonic range showed its inferiority to other wing configurations.

Drag evaluation was merely the last straw, according to Johnson. Before this, the Lockheed design teams found that the airplane would be directionally unstable at high angles of attack; stability reversed before the stall.

When trim studies were made, they discovered that there was a great loss of lift when the wing was trimmed for any given angle of attack. They were able to get suitable trim characteristics by moving the wing section outboard of

*"Airplane Configurations for Highspeed Flight," by Clarence L. Johnson, Chief Engineer, Lockheed Aircraft Corp.

Straight-Wing Defense

First release on the Douglas X-3 research aircraft (AVIATION WEEK Nov. 23, p. 13) might have prompted these two immediate questions:

- **Is that all the wing area?**
- **Why did Douglas use a straight wing?**

The design story on the glistening-white X-3 remains to be told; but there is a spokesman for the simple geometry of a straight wing.

"Kelly" Johnson, Lockheed's chief engineer, made a strong case for the unswept layout recently. Speaking at the recent SAE National Aeronautic Meeting well in advance of the appearance of Lockheed's own straight-winged F-104 fighter, he defended its conventional layout in an aeronautical world of triangular and swept shapes.

His arguments, detailed on these pages, could also apply to the design of the tiny wing of the X-3.

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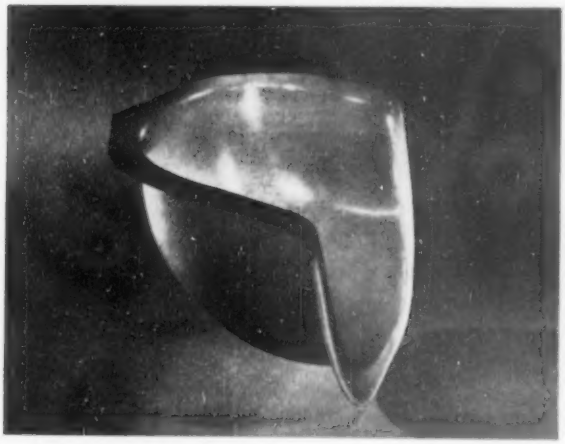

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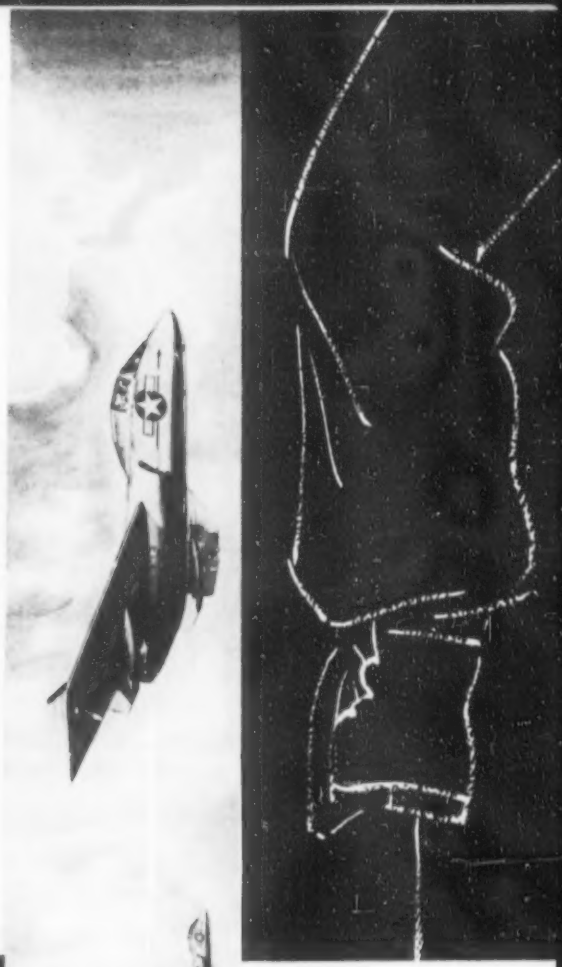

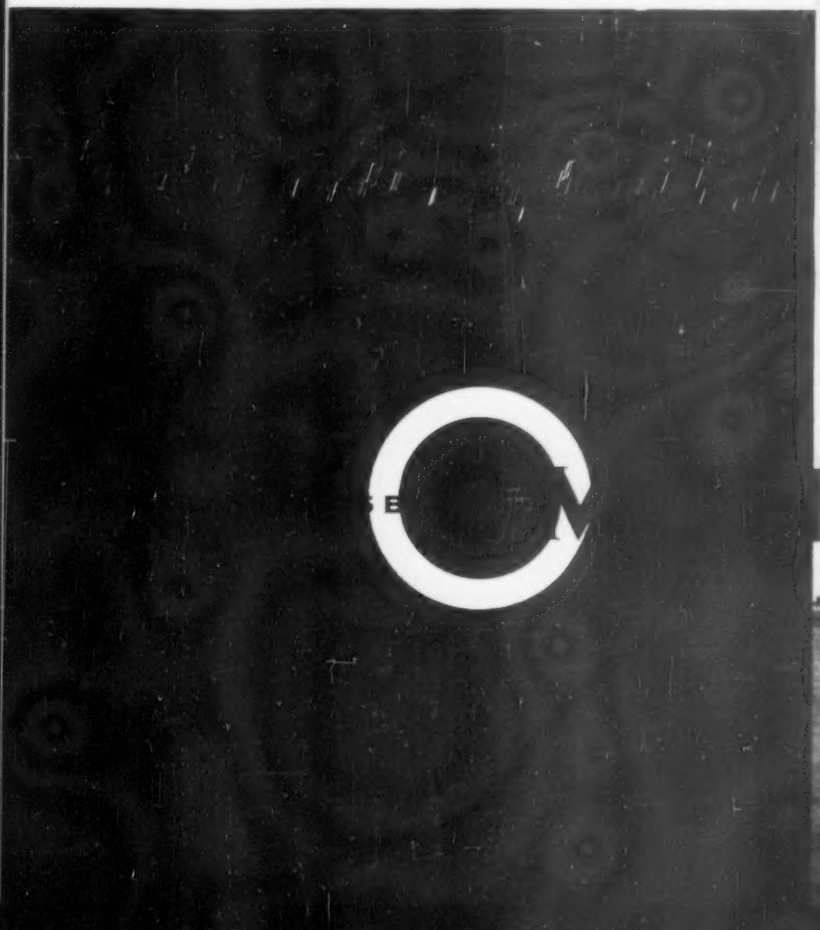

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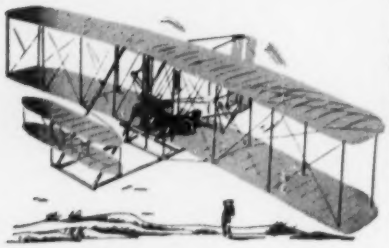

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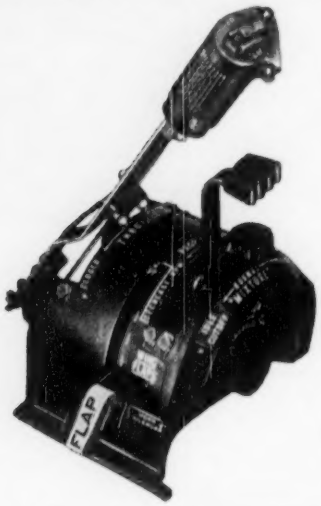

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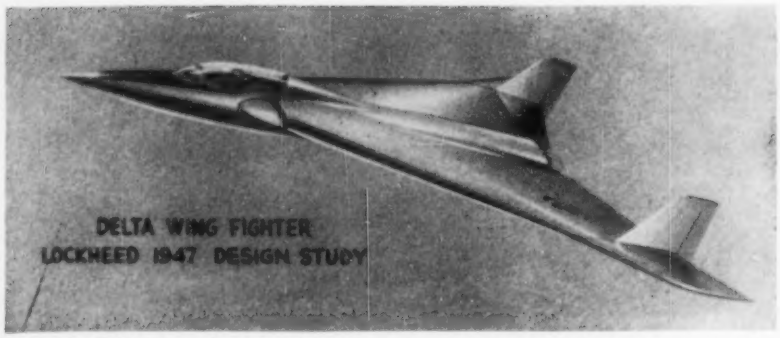


1947 STUDY convinced Lockheed delta was not answer to highspeed problems.

the vertical tail to deflections as great as −55 deg.

The lift-drag ratio was about half that of the F-80; to get the same kind of flareout on landing meant thrust output equal to half normal power of the powerplant.

The landing gear presented its problems; because of the flareout rate of descent, the shock strut had to travel 25 in., an abnormal amount.

The structure, usually thought of as an advantage with the delta type, had two adverse aspects. First, high suction loads on the upper surface were developed during pull-up maneuvers at low altitude. Second, stressed cover plates had to be used in quantity to provide access to equipment placed in the wing of the delta.

Finally, the weight of the delta proposal was a few hundred pounds more than a competing sweptwing design with a tail.

▶ **Delta Difficulties**—Johnson begins his arguments against the delta with these flat statements:

• "There has been very limited experience obtained with delta-wing-type aircraft."

• ". . . (delta-wing aircraft) have been flown almost entirely in the subsonic speed range. No delta-wing airplane has obtained the high speeds reached by rocket-powered straight or sweptwing research aircraft. In fact, few have reached speeds obtained by service aircraft. Within the next few years, this situation will, no doubt, be changed."

• "The advantages . . . of the delta wing are primarily those having to do with structure."

Chief drawback of the delta, says Johnson, is the very low maximum lift coefficients available. This is because of the leading-edge sweep, plus the necessary use of trailing-edge elevons to obtain pitch control.

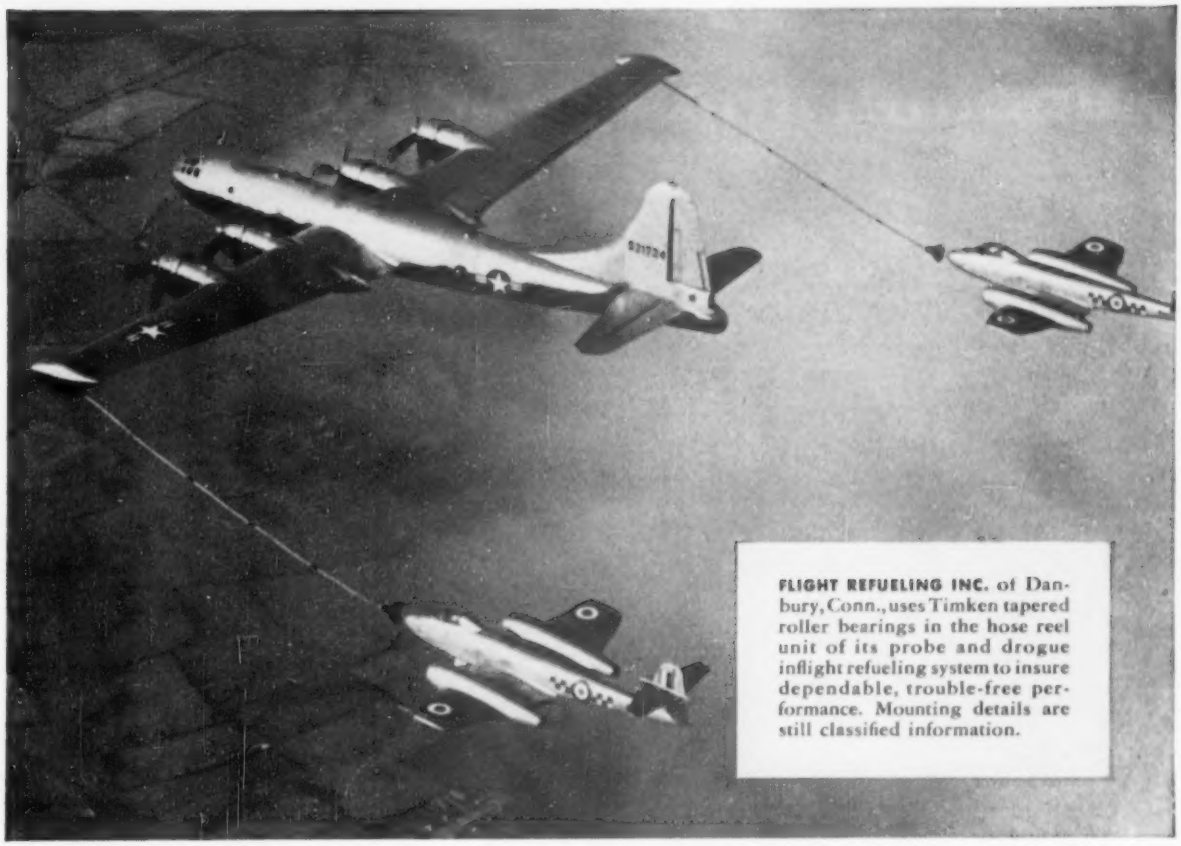
The structural advantages generally credited to the delta are, in many cases, due to the use of low aspect ratio and erroneously credited to the delta, he adds.

Says Johnson: "After years of drawing wings in the aspect ratio range of from 6 to 12, it is hard for a designer to bring himself to draw those of 2 and 3 in rectangular planform. When he does, it becomes immediately apparent that the delta airplane has no patent on

COMPARISON OF SURFACE AREAS - VARIOUS AIRPLANE CONFIGURATIONS

TABLE I

AIRPLANE MODEL	OVERALL LENGTH FEET	WING AREA		HORIZONTAL TAIL AREA		VERTICAL TAIL AREA		TOTAL AREA OF WING AND EMPENNAGE	
		SQUARE FEET	% OF WING AREA	SQUARE FEET	% OF WING AREA	SQUARE FEET	% OF WING AREA	SQUARE FEET	% OF WING AREA
F-80A	34.8	237.6	100	43.5	18.3	22.5	9.5	303.6	127.8
F-86	37.54	287.9	100	33.9	11.8	33.4	11.6	355.3	123.4
XF-92	42.5	425	100	—	—	76.1	17.9	501.1	117.9
F-94C	40.08	232.8	100	60.3	25.9	28.0	12.02	321.1	138.0
F7U-3	43.17	535.3	100	—	—	147.4	27.5	682.7	127.5
AVRO 698	109	4230	100	—	—	294	6.9	4524.0	107.0
AVRO 707A	34.17	426.5	100	—	—	29.9	7.0	456.4	107.0
GLOSTER JAVELIN	57.0	905	100	79	8.7	61	6.7	1045.0	115.5
BOULTON-PAUL PX-120	29.63								
BOULTON-PAUL P-111	26.1	291.0	100	—	—	33.5	11.5	324.5	111.5



FLIGHT REFUELING INC. of Danbury, Conn., uses Timken tapered roller bearings in the hose reel unit of its probe and drogue inflight refueling system to insure dependable, trouble-free performance. Mounting details are still classified information.

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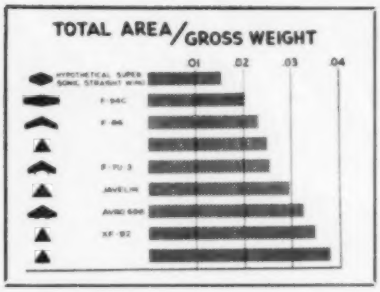


the structural advantages that go with low aspect ratio."

▶**Not Tailless**—Johnson says that the delta-winged airplanes make up for their lack of horizontal tail by requiring "... terrific vertical tails." From measurement of contemporary types, he shows that the total surface area of the deltas—without horizontal tails—is, in some cases, as much as the area of conventional aircraft with the horizontal tails.

Furthermore, he says, the low wing loadings that are required to get reasonable takeoff and landing distance for a delta result in higher surface area per pound of gross weight than conventional types.

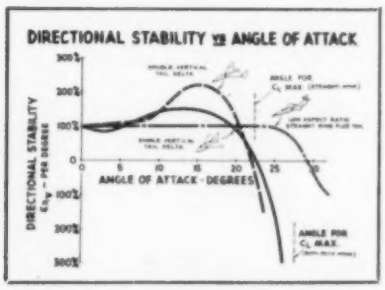
The overall delta performance can be improved by the addition of a horizontal tail with some reasonable tail length, Johnson states, and thus you can carry higher wing loadings.

One of the primary advantages credited to the delta is the availability of space within the wing. Johnson says that flight at supersonic speed requires wing thicknesses so low that this advantage disappears.

Actual delta designs show that fuselage cross-section and length are as great for the delta as for the conventional airplane, and Johnson adds that it is impossible to reduce the cross-section of engine, equipment, ducts or the pilot—by the choice of wing planform—to any important degree.

▶**Greater Drag**—This adds up to greater drag for a delta at supersonic speeds because—even though fuselage drags are similar to conventional types—lower wing loading and large vertical tail area increase the total.

"A major error in evaluating the delta type is generally made in considering



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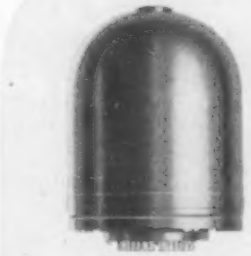

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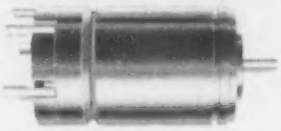

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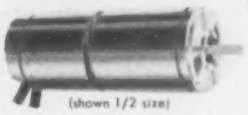

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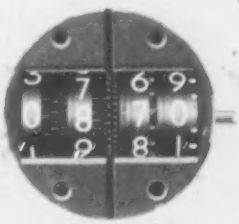

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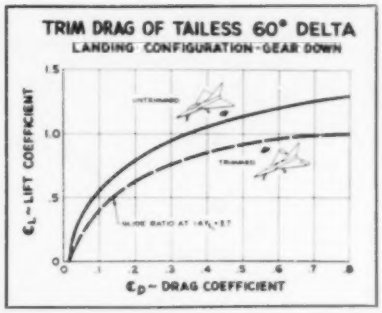

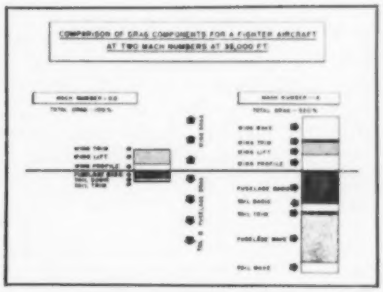

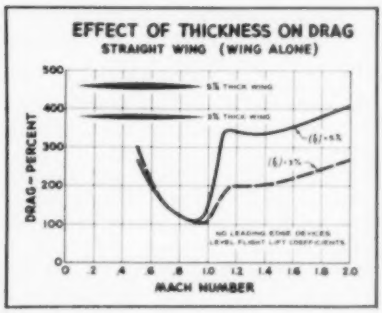

wing area without considering maximum lift and drag at high angles of attack. While the pounds per square foot sound good falling off the slide rule, the wing doesn't show up very well with its limited pitch control and low usable maximum lifts on takeoff and landing."

Then he concludes that the major advantages of the delta type are in its structural rigidity and in the improved space generally available in this configuration.

▶**Not Swept, Either**—Johnson doesn't believe in the sweptback wing as a contender with the straight wing at high supersonic speeds.

That opinion he backs up by explaining that the undesirable characteristics of the swept wing become apparent when the leading edge sweep angle increases for supersonic speeds.

Structurally, the swept wing has a high aspect ratio, even though its aerodynamic aspect ratio may be low. This means high fuselage and wing weights, and aero-elastic problems. Available maximum lift is poor, and there is always a chance of pitch-up near the stall.

▶**Straight Wing**—Johnson's definition

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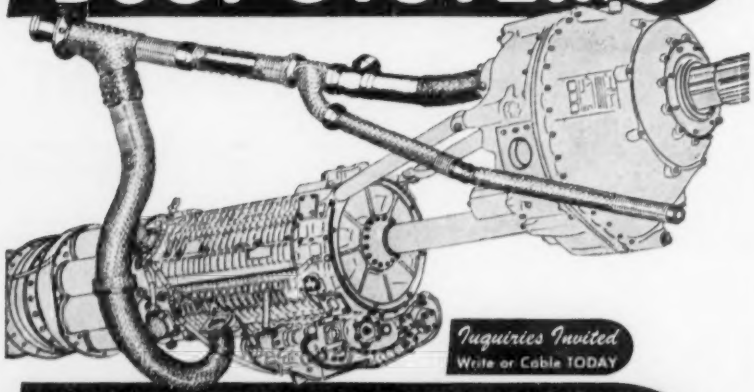

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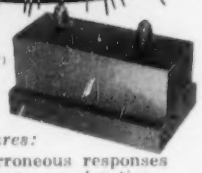

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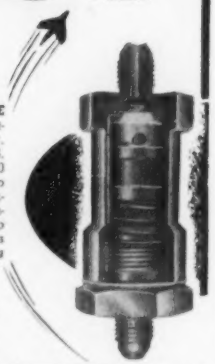

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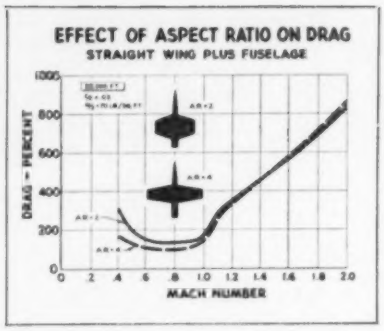


of a straight wing is one which is unswept on a line somewhere between 25 and 70% of the wing chord. Such a wing probably must be tapered for structural reasons. If the low aspect ratios of the delta wing are acceptable to pilots, then Johnson is willing to use similar aspect ratios. Then, he says, you have to screw up your courage and draw a comparable straight wing planform. With that, it is possible to obtain wing thicknesses of 5% or less.

The major problems are aero-elasticity and flutter, but these are capable of solution, says Johnson.

The straight-wing airplane will have the same sort of stability problems that have been badgering aerodynamicists for years, and in common with all low-aspect-ratio layouts, will probably require artificial stability devices to take care of the combination of lateral and directional effects.

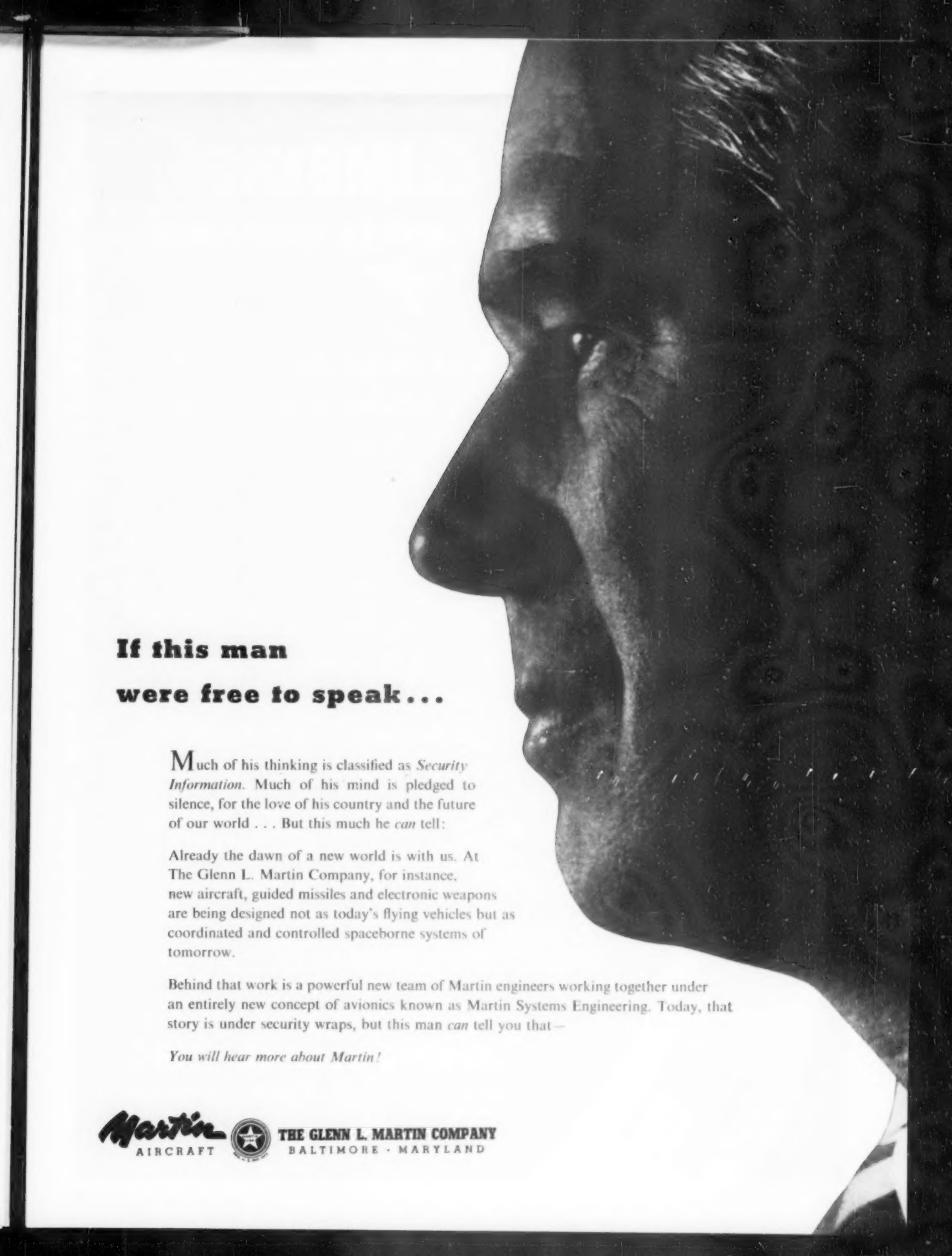
▶ **Specifically**—To illustrate the points, Johnson makes a drag comparison of the typical tailed fighter at Mach 0.8 and Mach 1.6. At the higher speed, the drag has been increased to 520% of its subsonic value. In the breakdown, wave drag—negligible at subsonic speed—becomes extremely important in the supersonic range. Pitching moments of wing and tail cause measurable amounts of trim drag.

Thickness drag is extremely important in the supersonic regime. At Mach 1.5, for example, a 3% wing has only 63% of the drag of one that is 5% thick.

Subsonically, the situation is reversed to some degree because of flow separation at the leading edge of the thinner section.

Johnson points out an omission of early design studies. These assumed that the variation of the airplane efficiency factor "e" used in the denominator of the equation for induced drag coefficient became constant at increased values of Reynolds' number. But this is not so, he says, and thus the earlier studies developed substantial errors.

▶ **More Comparisons**—Considering effects of aspect ratio, Johnson shows a graph which plots drag against Mach number for two aspect ratios. "There is nothing good aerodynamically about



If this man were free to speak...

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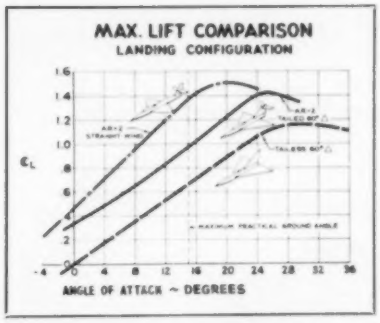


low aspect ratio," Johnson points out. But it is required for highspeed airplanes in order to get low thickness ratios.

The comparison has been made with a wing-fuselage combination because so much of the wing area of a low-aspect-ratio wing gets buried in the aircraft fuselage.

Trim drag is important for the tailed airplane, although in the case of the delta it is considerably larger. In a comparison of trimmed values of maximum lift-drag ratio, the delta shows a consistently lower value over the entire speed range.

Lift Considerations—The best planform for obtaining optimum usable lift is the straight wing, says Johnson. Leading-edge and trailing-edge devices are extremely effective. For a given wing area, more usable area is outside the fuselage to be affected by lift devices and to develop lift. The shorter chord requires less down load on the tail for trim.

When comparative maximum lifts are plotted for the delta, tailed delta and straight wing, the straight wing is superior.

Stability problems are common to all supersonic airplanes, says Johnson, where the design uses low aspect ratio and high sweep in the wings and a long, dense fuselage. He looks for yaw and roll dampers to become standard equipment.

At low angles of attack, flight characteristics may well be quite reasonable, but at high angles, problems still exist.

Some types, according to Johnson, exhibit tendencies to lose or reverse all directional stability and "swap ends" at high angles of attack. Some others will have high rates of roll just above takeoff speed.

But there is hope; the transonic trim changes which plague designers today will automatically disappear with reduced wing thickness and better aerodynamic form.

Concluding his stability comments, Johnson says that Lockheed tests have shown that overall stability and control characteristics are superior for the straight wing aircraft with a proper tail over other types.

(*Advertisement*)

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.

Knowing the delicacy of the subject, and not being one to avoid a controversial issue, I opened what turned out to be a rather lively discussion, with the question:

How does the Whittaker Company feel about entertainment?

Vice President Glenn Whitaker, who turned out to be the spokesman for the group, began:

"Unfortunately, Marv, the word entertainment has gained a bad name in government and industry during recent years. If you mean the lavish deals, big parties and hyperspecial—and expensive—attention that has received bad press in past years, then we want no part of it.

"Nor do the other steady, reputable suppliers as well as the vast majority of buyers and engineers. No company with good products and sound pricing needs to resort to bribes and lavish entertainment.

"On the other hand, no company needs to turn its back on human nature.

"We are all for hospitality. To us, hospitality means good taste, friendship and understanding. You know how it is when you are talking with a customer at his office. His time is short, and so is yours. You can't spend too much time just chatting.

"Discussions at the conference table or over the drafting board are basic to solid business relationships. By the same measure, an informal talk over a luncheon table, during a golf game or other social events, can accomplish a great deal in helping us to know our customers better and affording them the opportunity to learn more about us."

Glenn went on to point out that Whittaker has great faith in its field representatives, and added that it is simply good business to have the company's customers know these men well.

"For this reason we have always encouraged our people to spend as much time as possible with our customers," he continued.

"I know from experience that when our men spend an evening with their customers, much of the conversation will hinge around the Whittaker Company, their policies, their personnel, their history, their plans for the future, and so forth. It's beneficial for the customer himself to know as much about our company as he can. You can't really know a person well, if you see him only in a business office."

There's another side to the picture, Glenn pointed out: The Whittaker Company classes as "ridiculous" the lengths to which some plants have gone to prevent their men from being "influenced" by suppliers – to keep business transactions on the cold, impersonal plane of paper work.

"We know of cases," Glenn said, "in which manufacturers have given strict orders that an employee cannot even accept a luncheon from a vendor!

"This, to me, would indicate a complete lack of faith in the employee's integrity, even in his ability to make proper decisions. In my book, any man whose decisions could be influenced by *any* form of vendor entertainment – let alone a luncheon check – should be fired anyway."

Glenn stressed the benefit that buyers and engineers derive from spending some of their own time with suppliers.

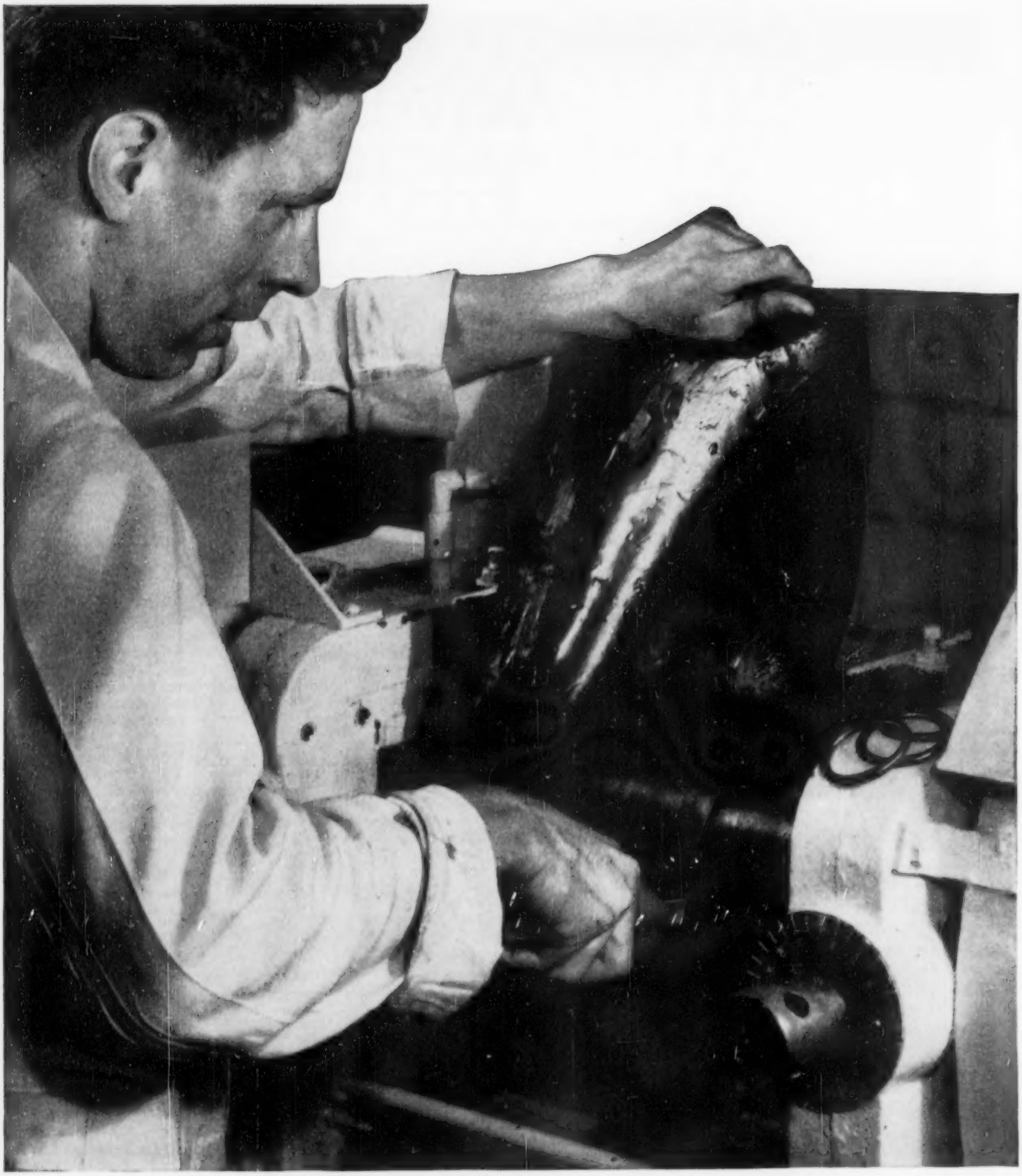
"If you get to know a man in his off hours as well as during his working hours, you can certainly form a much better opinion of his judgment, his capabilities, and the value of his word," he contended.

Summing it up, the Whittaker people have always enjoyed the privilege of playing host to their friends in the industry. By such hospitality, they've gained the distinct advantage of becoming known not only as a company, but as individuals, with many of the same hopes, the same problems, as you and I.

Glenn concluded:

"This hospitality has never won us an order and it never will, but it has given us the opportunity to really get to know our customers, and they have come to know us better. And because of this, they are better able to weigh the facts, the data and the claims that we must constantly lay before them.

"Marv, this is good business for both parties, and no one can deny it."



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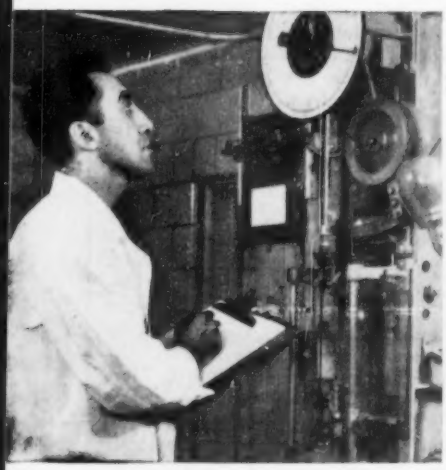

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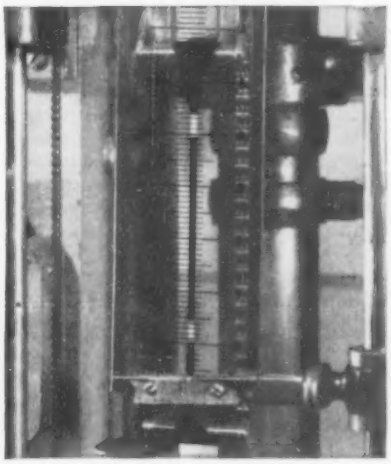

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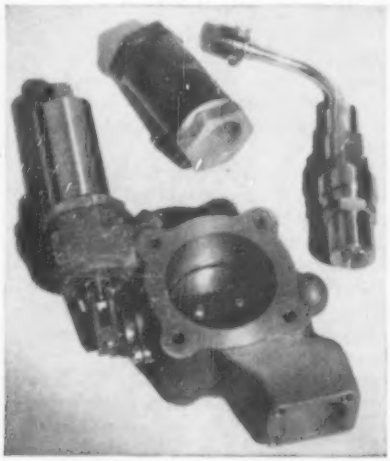

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Military-Civil Battle Rages Over DME

- **CAA resisting Defense Dept. push to make it abandon its present DME for newer armed services' type.**
- **Outcome of five-year-old conflict will determine future civil navigation system to be used in the U. S.**

By Philip Klass

Outcome of the battle now raging over civil versus military type DME (distance measuring equipment) is expected to have far-reaching effects on the U. S., and possibly foreign, civil navigation systems for the next 15 to 20 years.

The controversy is this: Should the Civil Aeronautics Administration abandon its present civil DME system in favor of a newer military version (AVIATION WEEK Nov. 23, p. 18).

Root of the fight, which far transcends DME, created sharp cleavages five years ago within Special Committees 31 and 40 of the Radio Technical Commission for Aeronautics, formed to develop a "common system" of air navigation and traffic control suitable for civil and military use.

The controversy came to the fore in the spring of 1951, following the outbreak of the Korean war. It led to mass resignations of the Navigation Committee of the Research and Development Board, and emasculation of the authority of the Air Navigation Development Board. (ANDB was set up in 1948 to supervise the overall development of the many different projects needed for the Interim and Ultimate Common System.)

Whether the recently announced reorganization of ANDB (AVIATION WEEK Nov. 9, p. 108) is a result of the present military-civil DME squabble is not clear.

▶ **Military System**—Few details have been released on the new military system, called TACAN (Tactical Aerial Navigation), for security reasons. However, the general characteristics of the system can be pieced together from information contained in the report by RTCA's Special Committee 31 and guarded statements approved for release.

TACAN is designed to provide a variety of navigation and traffic control functions. A single airborne unit is capable of giving both omnirange-type bearing and DME-type distance information. The same airborne unit, it is reported, also can perform as a radar transponder (safety) beacon to identify the airplane on ground radar scopes.

SC-31 expected the single airborne unit also to give information on plane height and to provide voice communications and "private line" communications of standard command instructions from the ground and acknowledgment from the air.

No one will say whether TACAN today is capable of providing all of the services envisioned by SC-31, or whether these are objectives for further development.

The system, originally developed by Federal Telecommunications Lab for the Navy, has been adopted by the Air Force for inter-service standardization. However, there are reports that some circles within the USAF are not too happy over this policy.

▶ **Military Proposal**—The military are believed to have proposed that CAA change or convert its present DME stations to the new military system.

If this were done, and new civil airborne DME were designed for the military system, these units would get only distance information when they interrogated the converted CAA ground stations.

Military aircraft, equipped with the full TACAN unit, would get both distance and bearing information. Civil aircraft would continue to use VORs (omniranges) to get bearing indications.

▶ **Behind the Proposal**—Unless the military can sell their proposal, they must choose between two unpleasant alternatives:

- **Set up and operate** in the U. S. a military (TACAN) airways system that essentially duplicates the existing civil airways.

Cost of this alternative, including equipment installation and maintenance costs, is said to be around $50 million.

- **Equip aircraft** with both civil and military navigation equipments to enable the planes to operate in the U. S., yet allow them to pick up at a moment's notice to fly to an overseas tactical area.

Penalty for this approach is the cost and trouble of maintaining dual airborne equipments in military aircraft and trying to find space for them in jam-packed fighters and interceptors.

▶ **Proven System**—Civil DME proponents say there is nothing wrong with the present CAA system, that it is debugged and proven. They say a change would force CAA to scrap some $12-15 million worth of ground stations, half of which already are installed and in, or ready for, operation.

They cite two manufacturers (Bendix/Hazeltine and Narco) that have more than $500,000 worth of orders for airborne civil DMEs and expect to start shipping in a couple of months.

Abandoning our present DME, civil proponents say, would shatter the U. S. position with the International Civil Aviation Organization and foreign countries, which only recently began to buy VORs and are presently negotiating for DMEs.

Civil DME proponents say TACAN still has "bugs" in it and that even when these are licked, the system is not capable of performing all of the functions claimed for it.

They argue that military aircraft already are equipped and using VORs and ILS, and should adopt civil DME.

▶ **Taxpayer Benefits**—Supporters of the military DME say CAA's ground stations need not be scrapped, that they

Exclusive Report

Reports of top-level Defense and Commerce Department negotiations aimed at getting Civil Aeronautics Administration to abandon its present civil DME (distance measuring equipment) raise serious clouds over the present program, despite reassurances from CAA.

These doubts come at a time when the civil DME program is ready to roll: Many ground stations now are in operation; production airborne units will be available in 30-60 days.

The negotiations, behind closed doors, involve more than the future of civil DME. The outcome of the controversy easily could reshape the future civil navigation system used in the U. S. and abroad.

To give its readers an insight into the issues behind this argument, and some of its important implications, AVIATION WEEK presents this exclusive report.

can be converted at relatively low cost. Looking at the overall picture, they say, a change to military DME would benefit the taxpayer.

Military DME proponents deride claims that TACAN does not perform satisfactorily, and say they have proof but cannot show it for security reasons.

The civil aircraft user will benefit by a change to military DME, its supporters say, because a single airborne unit can serve both as a DME and as a radar transponder (safety) beacon, saving the expense and weight of a separate beacon. (ANDB has a safety beacon now under development, AVIATION WEEK Aug. 17, p. 418.)

The military says it cannot use the civil navigation system in a tactical combat area because it lacks "security"—enemy aircraft can use or jam it too easily. Military also says it cannot afford to penalize performance of new fighters and interceptors by carrying six or seven avionic boxes when one TACAN unit will do the job.

▶ **Common System**—Changing to the military DME, its supporters say, would put the U. S. back on the track of the "ultimate common system," proposed by SC-31 and representing at that time the consensus of top military and civil experts.

If this is done, the SC-31 concept of a single box providing bearing, distance, height, radar beacon, private line and possibly voice communications, eventually will be realized. The present civil DME system, they say, doesn't have this potential for growth.

Civil DME supporters freely admit that the present DME, like VOR, is an "interim" system until a single multi-purpose "black box" is feasible.

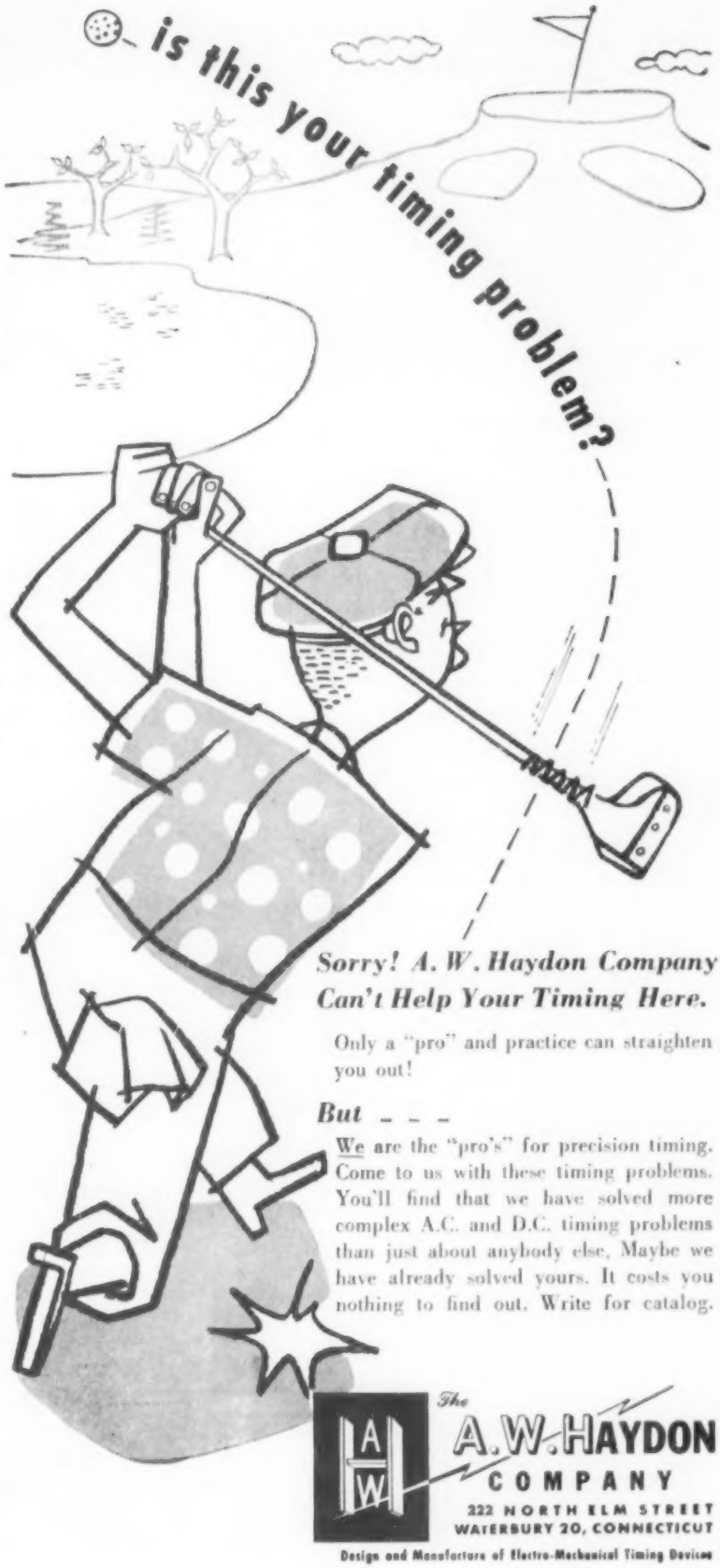
They point to the December 1948 report of SC-40—also made up of top experts, many of them members of the earlier SC-31—that set the standards for the present civil DME.

Based on this report, about 20% of the available radio spectrum (250 mc.) was set aside for interim (civil) DME and the remainder was reserved for "the development and utilization of the navigation portion of the 'ultimate common system.'" So the civil DME proponents say we still can go to a multi-purpose black box, when and if the state of the technical art permits.

But the military reply that a full 250-mc. band is needed if the multi-purpose "ultimate common system" is to be achieved. Otherwise it is like trying to squeeze a size 11 foot into a size 10 shoe.

▶ **Fundamentally the Same**—In the face of these sharp claims and counter-claims, it is surprising to find that the two types of DMEs are fundamentally the same.

Both operate in the 1,000 mc. region. Both determine distance to the ground



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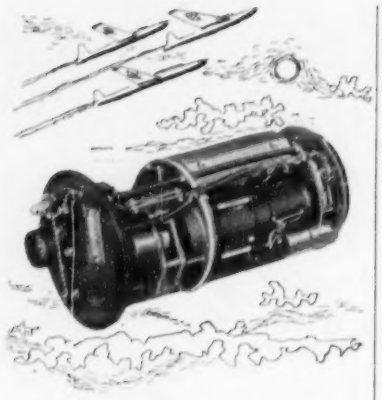
station by sending out a pulse (or pair of pulses) that interrogates or triggers the ground station to reply with a similar pulse and then measuring the elapsed time between the interrogation pulse and receipt of the reply.

Fundamental difference between the two types of DME, and the one leading to the present impasse, is the technique employed to give the many separate interrogation and reply channels needed to prevent an airplane's interrogation pulse from triggering unwanted DME ground stations in the area. Spurious triggering can overload these ground stations and deny service to aircraft that are trying to interrogate them.

► **Clear Channel Vs. Pulse Multiplex**—The civil system divides the 50-mc. band recommended by SC-40 into 10 interrogate channels, separated by 2½ mc., and 10 relay channels—also with 2½ mc. spacing.

However, 100 interrogate and 100 reply channels are needed to prevent interference in high density areas. To provide the necessary channels, pulse multiplexing is used.

This means the civil DME transmits a pair of pulses, coded by one of 10 different possible time delays between the two pulses (for both interrogation and reply). The combination of 10 different frequency channels and 10 dif-



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ferent pulse spacings (modes), provides the necessary 100 discrete channels.

The military system is believed to use the entire 250-mc. band, dividing it into 100 interrogate and 100 reply channels, each separated by only 1½ mc. Pulse multiplexing is reserved for transmitting information other than distance.

► **Sharp Disagreement**—Before SC-40 rendered its recommendation in 1948 for an interim DME using pulse multiplexing and 50 mc. of the available 250 mc. band, the committee was reported to be torn by sharp disagreements among its members over the wisdom of this recommendation.

It is said that Navy and some Air Force representatives felt the SC-40 DME system could be saturated too easily when large flights of aircraft descended on an aircraft carrier or military base.

The Navy was reported to be unable to satisfactorily use VOR on its carriers because of the omnirange beam distortion caused by moving ships in a task fleet.

Whatever the reasons, the Navy in 1948 launched a study-development program at Federal Telecommunications Lab for a multi-purpose, pulse-type navigation system, which became the present TACAN system. At some later date, USAF accepted TACAN for its future navigation system.

► **Battle Lines**—The battle lines are not drawn too firmly in some sectors. CAA is sticking by the present civil system, recommended by SC-40. CAA has invested its money in the system and anchored its present airways system to it. The military, with reservations on the part of some Air Force personnel is backing the change to its system.

The airlines and their Air Transport Assn. are sitting on the sidelines, watching the fracas. None of the carriers has ordered any DMEs, and they certainly

USAF Ground Radar

New surveillance radar, the AN/FPS-3, built by Bendix Radio division of Bendix Aviation Corp., is called "latest type heavy ground radar" by USAF. Set will presumably serve in air defense radar net.

How a B-47 Avoids a Nervous Breakdown

the problem: The "nerves" of the Air Force's B-47 jet bomber consist of a highly-complex series of electronic systems, each one dependent on every other one for efficient operation. These sensitive instruments would be unreliable and subject to failure if not adequately protected against the vibration and shock of landings, take-offs, turbulent air and gun recoil.

the solution: Because rubber or rubber-component shock mounts are subject to rapid deterioration by ozone and low temperatures at high altitudes, and because low temperatures impair their performance, conventional vibration-control mountings could not give dependable protection. Robinson engineers developed three separate types of Met-L-Flex* mountings which isolated these delicate electronic devices from the shock and vibration caused by landings, take-offs and rough air. These Robinson mounts are now standard equipment for most of the essential electronic devices (including the bombing system) on the B-47, "America's first line of defense."

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CONGO 'COPTER—Health authorities of the Belgian Congo have won a battle against dread disease-carrying insects. Sikorsky S-51 helicopters spray insecticides on vast breeding areas inaccessible to other aircraft or spray equipment. Leopoldville residents are reported now to be as safe from carrier insects as are New Yorkers.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS

"DRY RUN" RESCUE—Here a Navy HO3S Sikorsky helicopter awaits the loading of a "wounded" man carried on a stretcher improvised of poles and Navy jackets. This pickup was part of a practice operation for search and rescue helicopters and survival parties. The HO3S Sikorsky is specially equipped to carry litter patients.

UNUSUAL CARGO—This crashed Army L-19 liaison plane was salvaged with ease in Korea by an Army Sikorsky H-19 helicopter. Two trips were needed to fly the damaged wings, engine and fuselage (above, in cargo sling) to a repair depot. Army Sikorsky helicopters are now solving hundreds of tough, unusual transportation problems.

SPECIAL AIRLIFT—A wounded veteran, after months in a North Korean PW camp, is carried from an Army Sikorsky H-19 helicopter to a South Korean hospital in Seoul. As in earlier prisoner exchange activities, Army Sikorsky helicopters played a big part in the post-truce prisoner exchange, providing airlift for repatriated soldiers and other personnel.

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will not until the air clears. However, ATA is watching developments closely to see if any one suggests that the new military system should replace civil VORs as well as DMEs.

If that should happen, observers say ATA would jump into the fight. The airlines have a large investment in airborne VOR receivers, and ATA has spent much time and effort, with CAA, in working out the bugs from the omnirange airways.

Qualified observers do not expect such a move within the near future because it would compromise much of the remaining security of the military navigation system.

► **NBAA Opposes Change**—The National Business Aircraft Assn. is strongly opposed to abandoning the present DME system, a spokesman says.

Primary reason for NBAA opposition may be the fear that a change will increase the cost, size, and complexity of airborne units over present civil DME designs made by Narco and Bendix/Hazeltine. (Closer channel spacing in military system makes it mandatory to use crystal control and greater circuit complexity, increasing the price.)

Business aircraft operators constitute a potential DME market comparable to that of the scheduled U. S. airlines.

► **Producers' Stand**—Narco and Hazeltine Electronics Corp., whose DME is marketed and serviced by Bendix Radio, have built up sizeable inventories of material for production of civil DMEs, and both expect to be in production shortly.

Changing to military DME would force Narco and Hazeltine to scrap some, if not all, of their inventories. The recent upsurge of rumors of a change have come at a time when both Bendix and Narco were launching their long-planned sales campaigns.

Because 95% of Hazeltine's business is with the military and most of that is with the Navy, the company hardly is in any position to take sides in the current controversy.

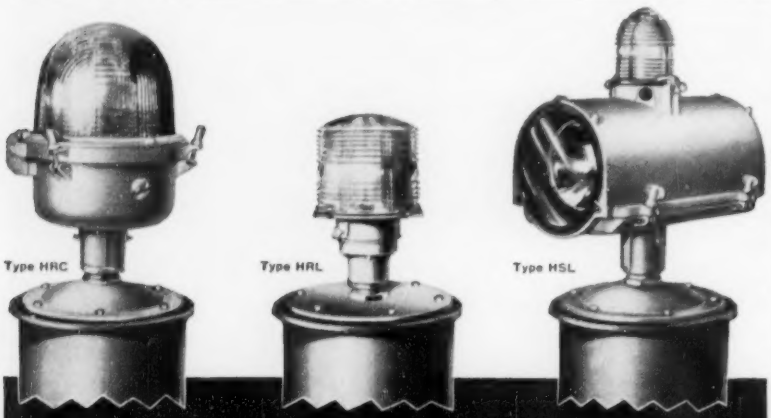
Federal Telecommunications Lab, which built an early civil airborne DME and developed the present TACAN system, presumably is in favor of a change—as evidenced by its lack of commercial activity in the present civil DME field.

► **No Obvious Solution**—To resolve the DME argument, a group of civil and military experts was formed to study the problems of compatibility. It is believed they recommend that a military conversion of a civil DME be attempted to determine its feasibility and cost—and that this has now been done.

Some industry observers say this trial conversion proved very successful; others say the contrary. Military security prevents obtaining an official answer.

Meanwhile, CAA is proceeding with installation of its DME ground stations, as the work load of its maintenance people permits. The longer the decision is delayed, the more stations will go in, tending to make the civil system position slightly more secure.

None of the experts involved in the controversy has come up with a compromise plan which will placate both the military and CAA. Unless the heads of the Defense and Commerce Departments can resolve the argument, it appears likely to go to the President.



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Type HRC utilizes a double prismatic lens system on a cast aluminum base, with a 500-watt, 115-volt lamp mounted on a movable socket. The main beams may be "toed in" or "toed out" by remote control from the tower to provide the best setting for particular visibility conditions. The candlepower is the highest of the three types. In bad weather the pilot sees more lights and sees them sooner with this system.

Type HRL is constructed with an optical prismatic Pyrex globe mounted on a 3-piece cast aluminum fixture assembly. Each fixture uses a 200-watt lamp and is provided with a series-to-series insulating transformer installed underground in the base housing.

This system has the lowest installation cost. Its use is often justified for non-instrument runways, as well as instrument runways.

Type HSL has a cast aluminum housing with two 95-watt sealed beam high intensity lamps inside and a 30-watt medium intensity light on top. Three insulating transformers are installed underground in the base. Each of the three lamps may be switched separately from the tower.

This system is economical to operate, since only 95 watts is used for the high intensity beam, and a 30-watt light is used in good weather. This fixture provides a main beam in only one direction, without the background haze resulting from the "back beam". After relamping, the sealed beam optical system is back to 100% initial efficiency.

All three fixtures provide the basic high intensity candlepower required and the three types have many construction features in common such as: cast aluminum housing, Pyrex glassware, disconnecting cable connector, same breakable coupling and standard steel base with base plate. All three units provide the necessary top light and side light needed for planes not on the approach path and all use a 5-stage brightness control.

Write for Bulletin 358-F. It contains detailed features and an impartial comparison of the relative advantages of the three systems with estimated installation costs of each.

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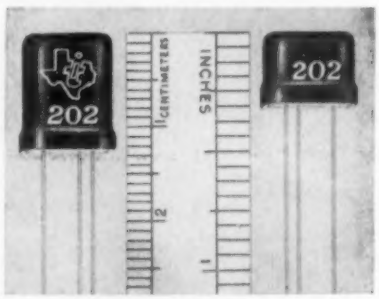
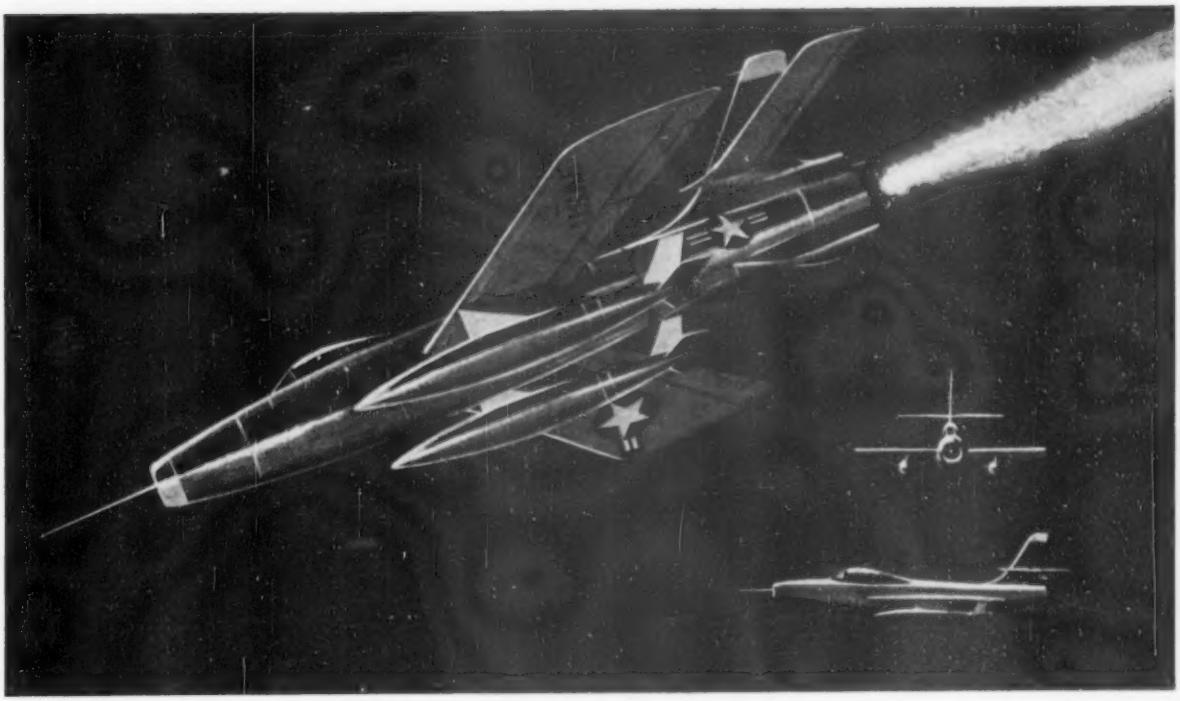


Tinier Transistor

Transistor size reduction of 40% is the result of a new 0.3-in. hermetically sealed case (right) which Texas Instruments Inc., Dallas, is now using to house its grown-junction n-p-n transistors. Address: 6000 Lemmon Ave., Dallas 9.



Republic XF-91

Rocket-powered, Supersonic, and Combat-Ready

Republic Aviation's XF-91 is the first American rocket-powered fighter-type aircraft to fly faster than the speed of sound. Yet it can also move so slowly that other jet fighters would have difficulty trailing it.

This fast-or-slow characteristic comes from its inverse tapered wings with leading edge slots . . . and the fact that the angles of swept-back wings can actually be varied in flight.

Monstrous power for the XF-91's supersonic research flights comes from three sources: A General Electric J-47, 5,200-pound thrust turbojet; an afterburner; and a 6,000-pound thrust rocket engine built by Reaction Motors, Inc. Together, they can push the XF-91 up to extremely high speed.

In its flight through the sound barrier, the XF-91 gets assistance from Inco Nickel and the Inco Nickel Alloys. These are used in vital engine parts and other places where combinations of corrosion resistance, heat resistance, strength and ductility are demanded.

Perhaps you have a metal problem calling for properties like these. Inco's Technical Service Section will gladly assist you in finding a solution. Write to them for the information you want.

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- Afterburner structural members

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- Gaskets
- Rocket engine turbine wheel

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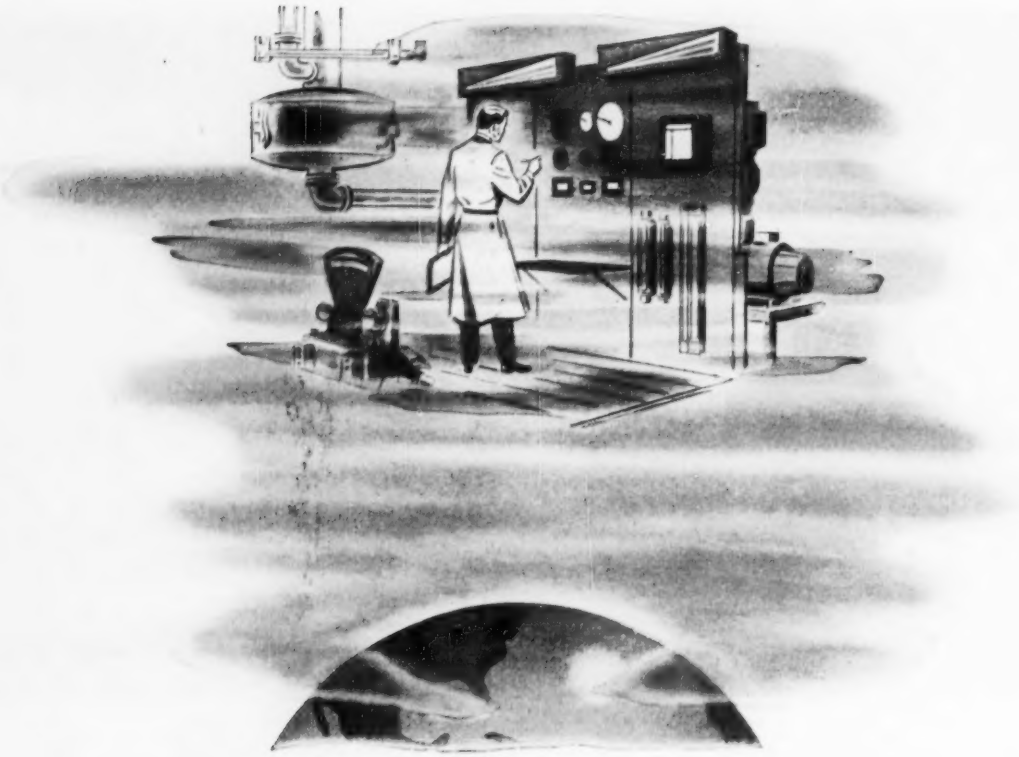

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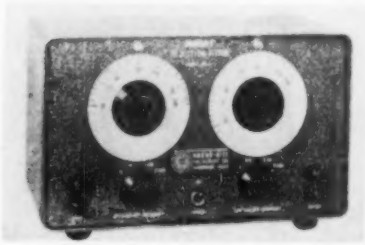
DEPT. AC-121 • CLEVELAND 17, OHIO

New Avionic Aids For the Laboratory

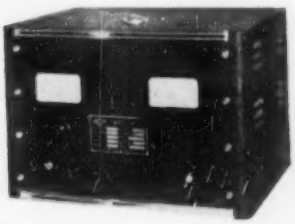
Recently announced test equipment and accessories for use in electronic laboratories include the following:

• **Rejection Filter,** Model 360A, which provides either a sharp single frequency null or a rejection band in which gain falls off at a rate of 24 db./octave, is available from Krohn-Hite Instrument Co. Both high and low cut-off frequencies are independently adjustable



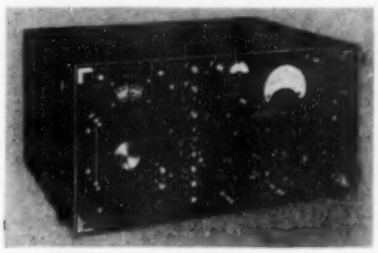
from 20 cps. to 200 kc. A sharp null can be obtained at any frequency from 100 cps. to 50 kc., manufacturer says. Address: 580 Massachusetts Ave., Cambridge 39, Mass.

• **D.C. Power Supply,** for converting 115-v., 60-cps. power to 1.2 to 30 v. d.c., uses magnetic amplifiers to hold output voltage constant to within 1% from no load to full load with a 10% variation of a.c. line voltage, according to its



manufacturer, Inet, Inc. Called Magni-Volt, the device is reported to have less than 1% rms. ripple and a regulation response better than 0.2 seconds under extreme load conditions. Address: 8655 S. Main St., Los Angeles 3, Calif.

• **Noise and Field Meter,** Model NF-105, commercial equivalent of the military AN/URM-7, can be used for noise and field intensity measurements in the frequency range of 20 to 1,000 mc., as well as performing as a standard impulse



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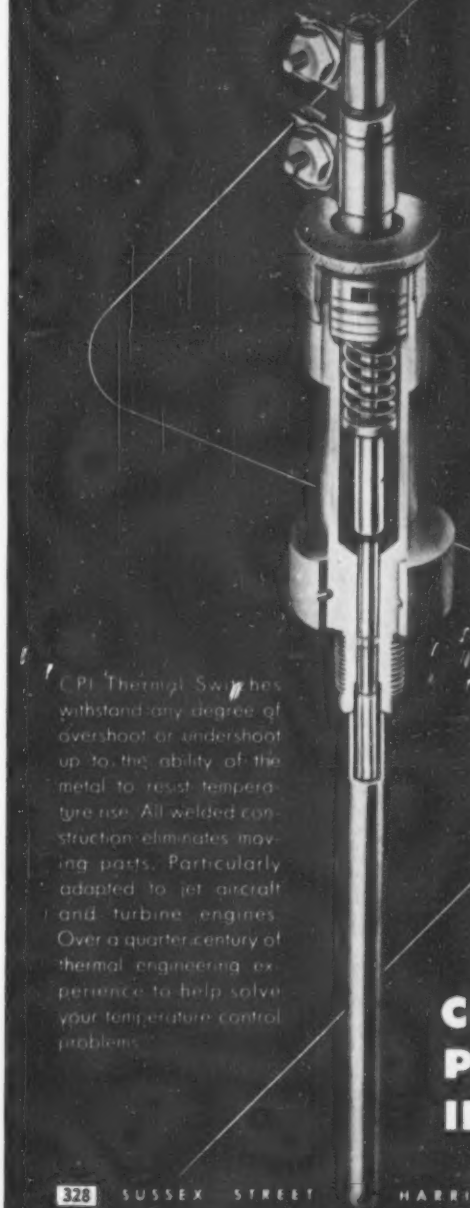

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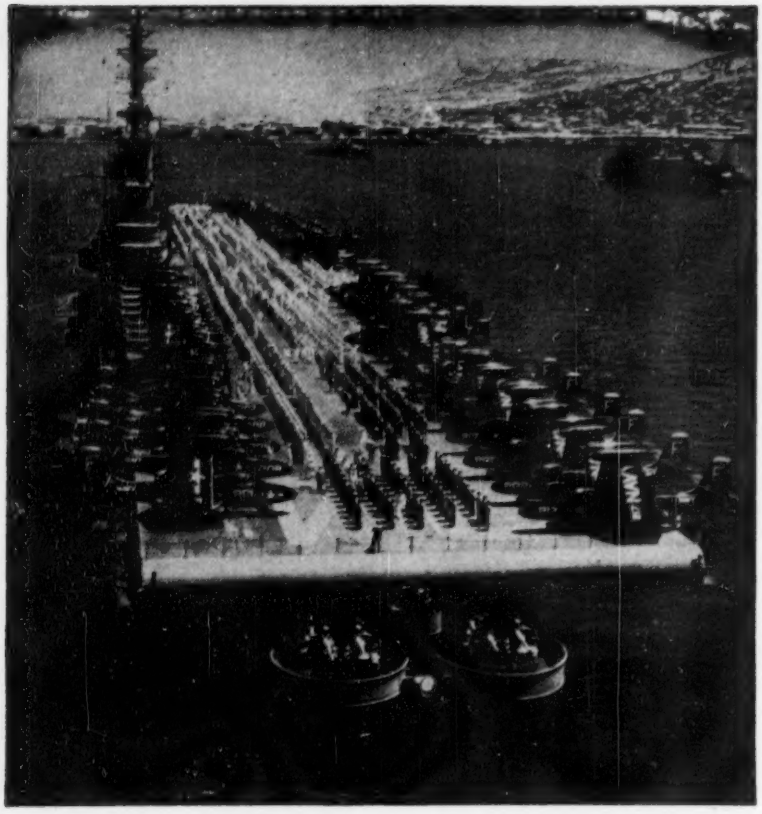

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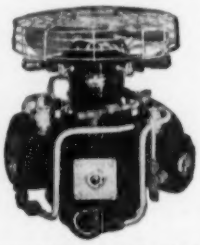

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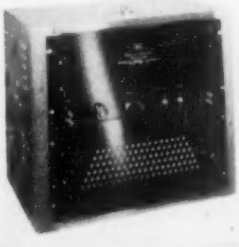
noise source and sensitive vacuum-tube voltmeter. Manufactured by Empire Devices Products Co., the device has a single tuning knob for quick frequency scanning and a built-in regulated power supply. Address: 38-15 Bell Blvd., Bayside 61, N. Y.

• **Power Amplifier,** Model B, will deliver 6.25 watts (into a 100-ohm load) when driven by a 10-v. signal from a low-level signal generator. Device has essen-

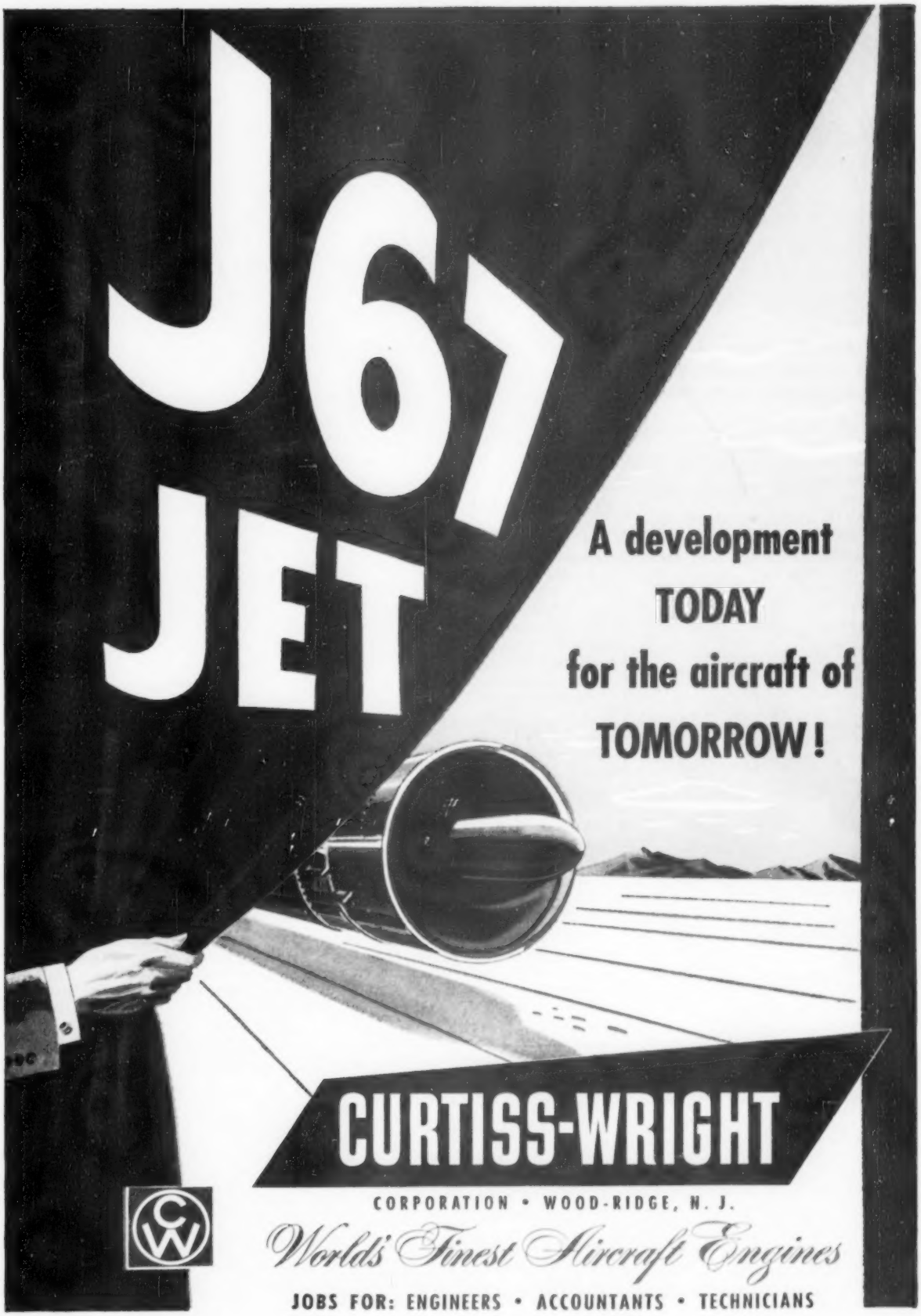


tially a flat response from 0 to 20,000 cps., according to manufacturer. Address: Southwestern Industrial Electronics Co., P.O. Box 13058, Houston 19, Tex.

• **Variable Impedance RF Wattmeter,** Model 141, for rapid power measurements in the frequency range of 2 to 30 mc. has been announced by Sierra Electronic Corp. Resistance term of device's input impedance can be varied between 5 and 500 ohms; reactive term can be adjusted between plus and minus 250 ohms. Impedance can be set to an accuracy of 5% and power measurement accuracy is 10%, manufacturer says. Device can handle up to 250 watts of power. Address: 1049 Brittan Ave., San Carlos 2, Calif.

Old and New

New M-H power transistor, rated at 20 watts, is shown alongside vacuum tube of comparable rating by Dr. Finn J. Larsen, research director at Minneapolis-Honeywell. New power transistor, which is being used in a prototype of a transistorized aircraft fuel gage, is not yet in commercial production, M-H says. New M-H development opens many new fields for transistor use.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The H-9100 Series latches are available in convex, concave and straight types. Maximum ultimate load is approximately 10,000 lbs. static tension. The toggle mechanism locks in place and applied load holds the latch closed. Simple tee-bolt and trigger opening action. They provide long, dependable service under severe operating conditions. Weigh only 9.5 to 14.2 ozs. according to materials.

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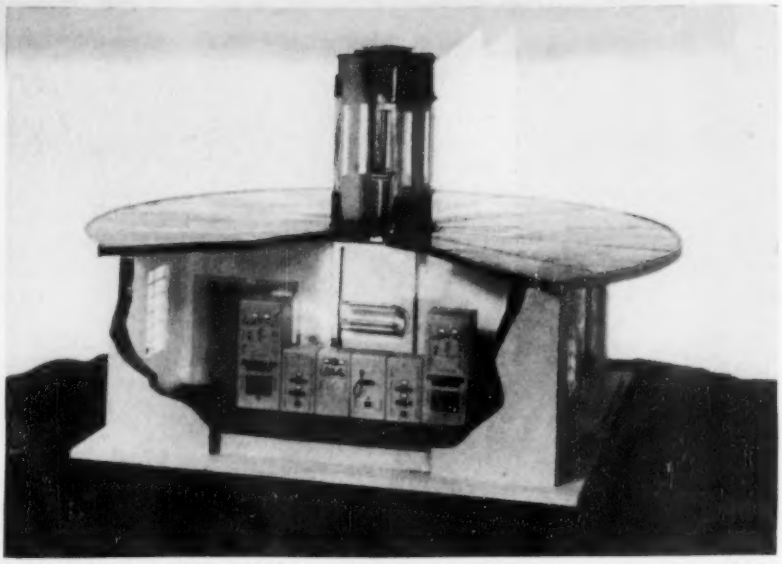

SCALE MODEL of Marconi VOR installation purchased by Swiss. Price is about $45,000.

Marconi Sells VOR to Switzerland

(McGraw-Hill World News)

London—Marconi Wireless Ltd. has announced the sale of the first British-built VOR (omnirange) installation to Switzerland and may soon be able to announce the sale of six or seven VORs to Britain's Ministry of Civil Aviation for installation in the U.K.

Another sign that VOR prospects in Europe are looking up is the report that British Overseas Airways Corp. is considering the installation of approximately 20 VORs along its Comet routes to Johannesburg and Singapore. A report recommending this action followed extensive tests by de Havilland Aircraft Co. and BOAC.

▶ **CAA Helps**—Growing interest in VOR is attributed in no small part to the good "salesmanship" of a small group of U. S. Civil Aeronautics Administration men in London who helped Marconi test its prototype VOR installation and demonstrate it to the Swiss authorities. CAA men also worked on the DH-BOAC omnirange study.

For the past two years, two U.S.-built VORs have been on loan from CAA to Britain's MCA, with CAA personnel training MCA people in the equipment's operation and maintenance.

The Swiss are reportedly planning to install their VOR at Zurich and are said to be considering the purchase of a second unit, to be sited on a mountain-top intersection of main air routes over Switzerland. The proposed site is to be studied further when the snows melt next spring.

▶ **Marconi Entrance**—Marconi entered the VOR business two years ago, following a technical interchange agreement with Radio Corp. of America.

Major European competitor for the VOR market is C. Lorenz of Germany, which has had several VORs working in Germany over the past two years. The Lorenz omnirange, which reportedly uses a rotating dipole antenna, sells for about $33,000. Marconi, which uses a non-rotating antenna (goniometer-fed), like most U. S. omniranges, sells for around $45,000.

New Devices Check Transient Data

New oscilloscopes and oscillographs for displaying and recording a variety of transient phenomena have recently been announced by several manufacturers. The new devices are:

• **Five-Channel Scope,** for simultaneous measurement of five different mechanical vibrations at frequencies up to 100 kc. has been developed by Franklin Electronics, Inc. Oscilloscope has five CRTs and push-pull amplifiers for each channel capable of accepting strain gage signals. Response is flat to 50 kc., company says. All five CRTs can be photographed on a single 35 mm film; a neon marker light provides a time base reference. (Franklin Electronics, Inc., 415 West Pike St., Philadelphia 40, Pa.)

• **Multi-Trace Oscillograph,** capable of recording 50 active data traces at input frequencies up to 3,000 cps. on a 12-in. paper or film has been announced by Consolidated Engineering Corp. Re-

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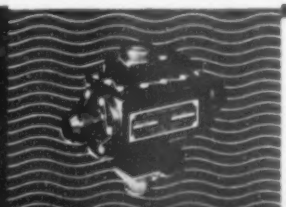
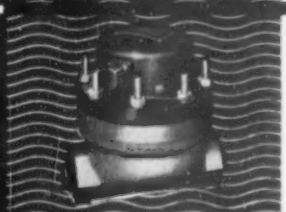
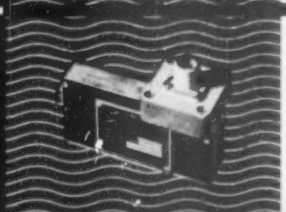
FUEL FLOW SWITCH
Specially designed by Revere for use in the auxiliary fuel line of the McDonnell F2H-3 twin-jet, carrier-based fighter. This instrument transmits a warning signal whenever fuel flow falls below a pre-determined value. *Send for Bulletin No. 1400.*



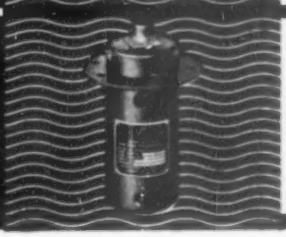
FUEL FLOW TRANSMITTER
The Revere Fuel Flow Totalizer is an integral part of the fuel system. It records the rate of fuel flow in the T-33's jet engines. The flow totalizer can be used on piston engines, diesels or test stand operations. *Send for Bulletin No. 1300.*

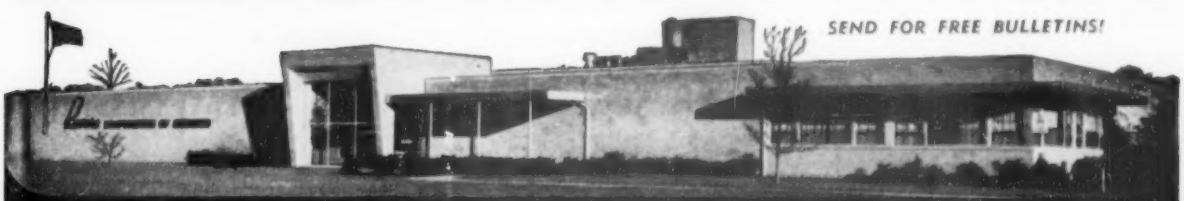


LIQUID LEVEL SWITCH
Republic's F-84G Thunderjet, first USAF fighter-bomber to refuel in mid air, has Revere's Liquid Level Switches installed in their fuel tanks. This hermetically-sealed, magnetically actuated switch presents a new standard of safety. *Send for Bulletin No. 1100.*



FLOAT SWITCH
Boeing's B-47 Stratojets have Revere Float switches installed in all fuel tanks to maintain high-level fuel control. These switches can be furnished with single or dual float systems with levels set at the factory. *Send for Bulletin No. 1200.*





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Delta C & S Airlines
Eastern Airlines
El Al Israel Airlines
Ethiopian Airlines
Flying Tigers
Garuda Indonesian Airways
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Hellenic Overseas Airways
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That's why you find Barber-Colman temperature control systems on so many airliners operating throughout the world. These precise-operating systems are the result of nearly 20 years' experience in cabin comfort control. In fact, the early DC-1 was Barber-Colman equipped.

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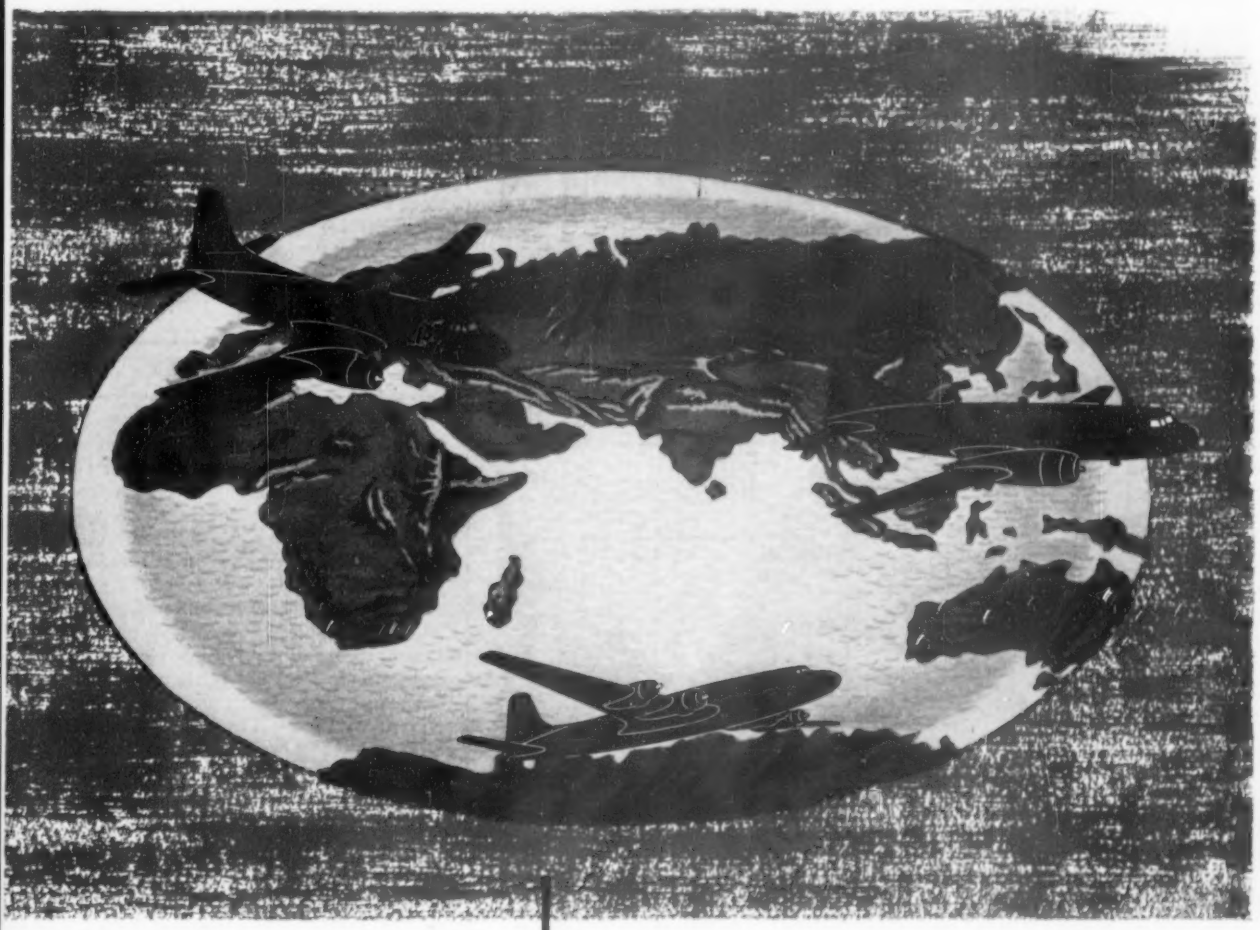
Whenever you have need for highly dependable temperature controls, consult Barber-Colman engineers for the system best suited to your particular application.



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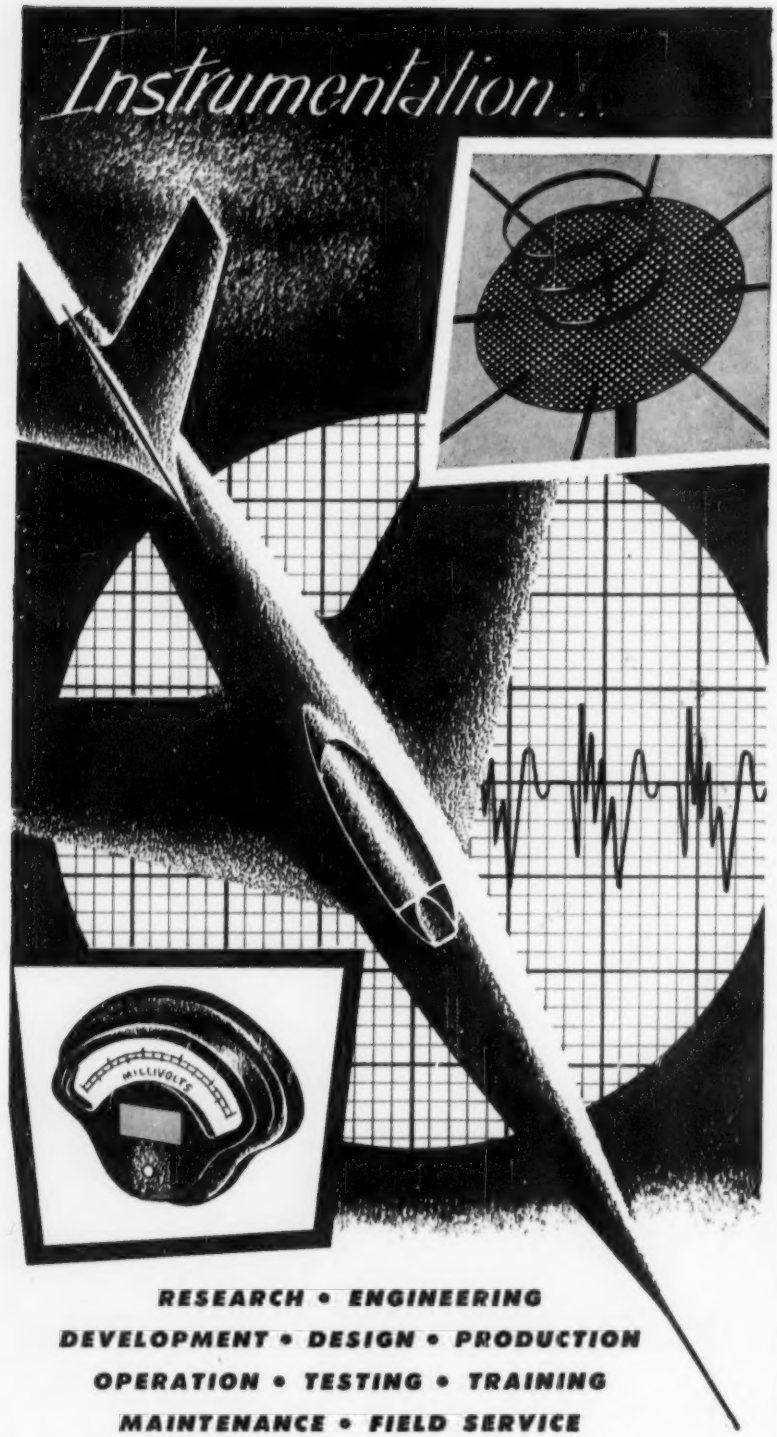

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cording speeds of 0.1 to 100 in./sec. are available through the use of easily-changed gearing, company says. A "jump switch" permits a 10-fold increase in record speed without stopping the oscillograph. New Type 5-119 oscillograph is available for operation from either 26 v. d.c. or 115 v. a.c. Input signals whose frequency is 10 to 500 cps. may be viewed as wave forms on a ground-glass screen, to permit visual check of wave deflection and to assure proper adjustment of galvanometer deflection. All operating controls, test circuits, and warning indications are on the instrument's front panel. Weight is 145 lb. (Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 8, Calif.)

• **Portable Oscilloscope**, weighing only 20 lb. and capable of operation from 115 v., 50 to 1,000 cps. power, has been announced by DuMont Labs. The new Type 301A has a band width of 10 cps. to 4 mc. (20% down) and contains circuits for precision calibration of both time and amplitude, DuMont says. A three-inch rectangular CRT is used. Dimensions are 9⅛ x 6½ x 16⅝ in. (DuMont Laboratories, Inc., technical sales dept., 760 Bloomfield Ave., Clifton, N. J.)

FILTER CENTER

▶ **CAA Installs Improved ILS**—Sixty-two ILS installations have now been equipped with an improved "null reference" glide slope antenna to reduce beam bending caused by snowfall, CAA reports. As much as two feet of snow on the ground will cause only 1/10 deg. of beam bending, CAA says. New antenna, developed by CAA's Technical Development & Evaluation Center at Indianapolis, also provides more uniform beam thickness, regardless of terrain, CAA reports. Improved antenna is going in at all existing ILS sites when new type transmitter and standby equipment are installed.

▶ **M-H Complete 40,000th Autopilot**—Top Air Force officials were on hand recently when Minneapolis-Honeywell rolled the 40,000th automatic pilot off its production line in Minneapolis. M-H, which entered the autopilot field in 1941 with the Type C-1 used in B-17s and B-29s, says it has produced more autopilots than any other firm.

▶ **Aerial Camera Computers Ordered**—The Bill Jack Scientific Instrument Co. has received a $9-million order for aerial camera computers. The devices are designed to compute plane's ground speed so camera's strip film can be moved at same speed to prevent image blurring.

—PK

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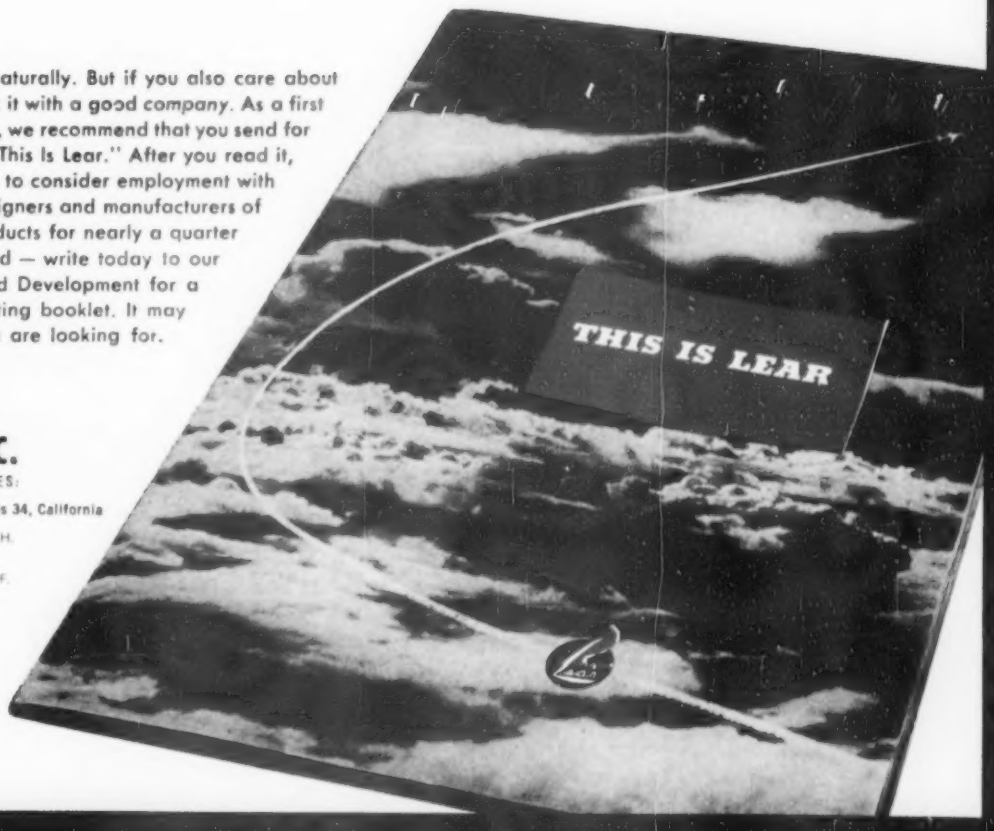

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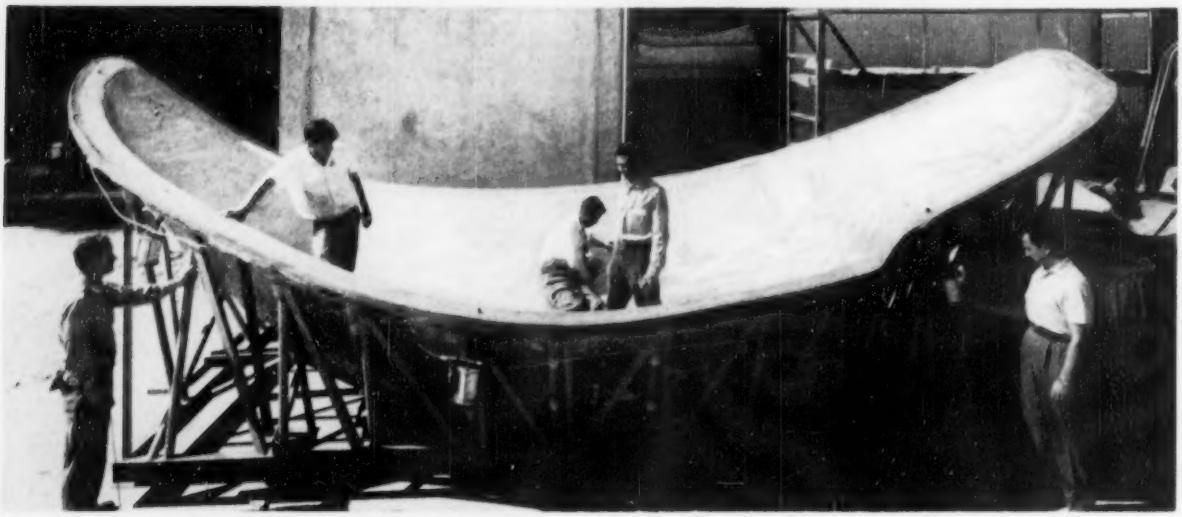
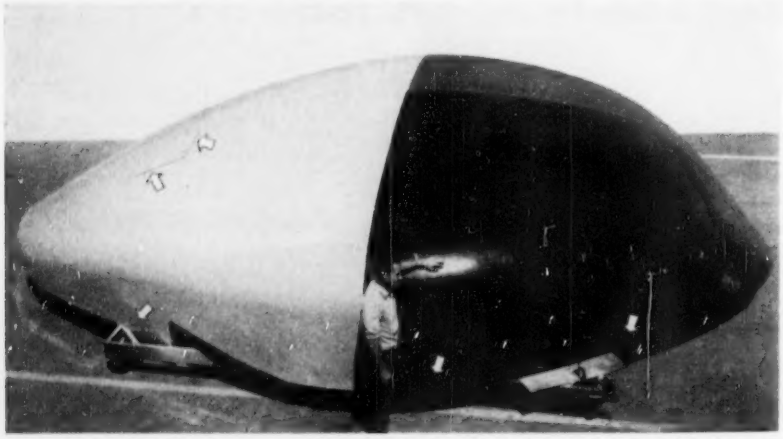


HUGE MOLD used in making half of radome. Man at right touches a trap in vacuum line used to apply necessary molding pressure.

How Mammoth Plastic Radome Is Made



RADOME INVERTED, arrows show attachment points (edge) and access plate (top l.).

RADOME INSTALLATIONS are prominent feature of USAF Lockheed RC-121C.

The huge size a reinforced plastic structure can take in a modern aircraft application is dramatically illustrated in the belly radome on Lockheed's Super Connie picket plane now in production for the Air Force (RC-121C) and the Navy (WV-2).

▶ **Giant Dome**—Probably, the largest plastic structure ever built, this 20-ft.-wide by 6-ft.-deep belly radome stretches 30 ft. along the bottom of the fuselage. It is complemented by an 8-ft. high radar antenna housing atop the fuselage. Both structures are built by Zenith Plastics Co., Gardena, Calif., a large-scale producer of reinforced plastic parts for many military aircraft (AVIATION WEEK June 15, p. 43).

Published for the first time, here are details and closeup photos of the belly installation and huge tooling needed.

▶ **Makeup, Side Details**—The large plastic structure is made in half sections to facilitate handling and installation. Bolts along the longitudinal centerline are used for joining the two portions. Material is a polyester resin-fibrous glass cloth laminate over a nylon-phenolic honeycomb.

Front half of the radome is protected by a rain-erosion coating, embodying a Neoprene compound, which is sprayed over the reinforced plastic skin. The row of bolts along the centerline split shows clearly against the dark area of the coating.

▶ **Back and Side**—Aft portion of the plastic structure carries no protective coating, is light gray in color. A large rectangular access plate on the surface

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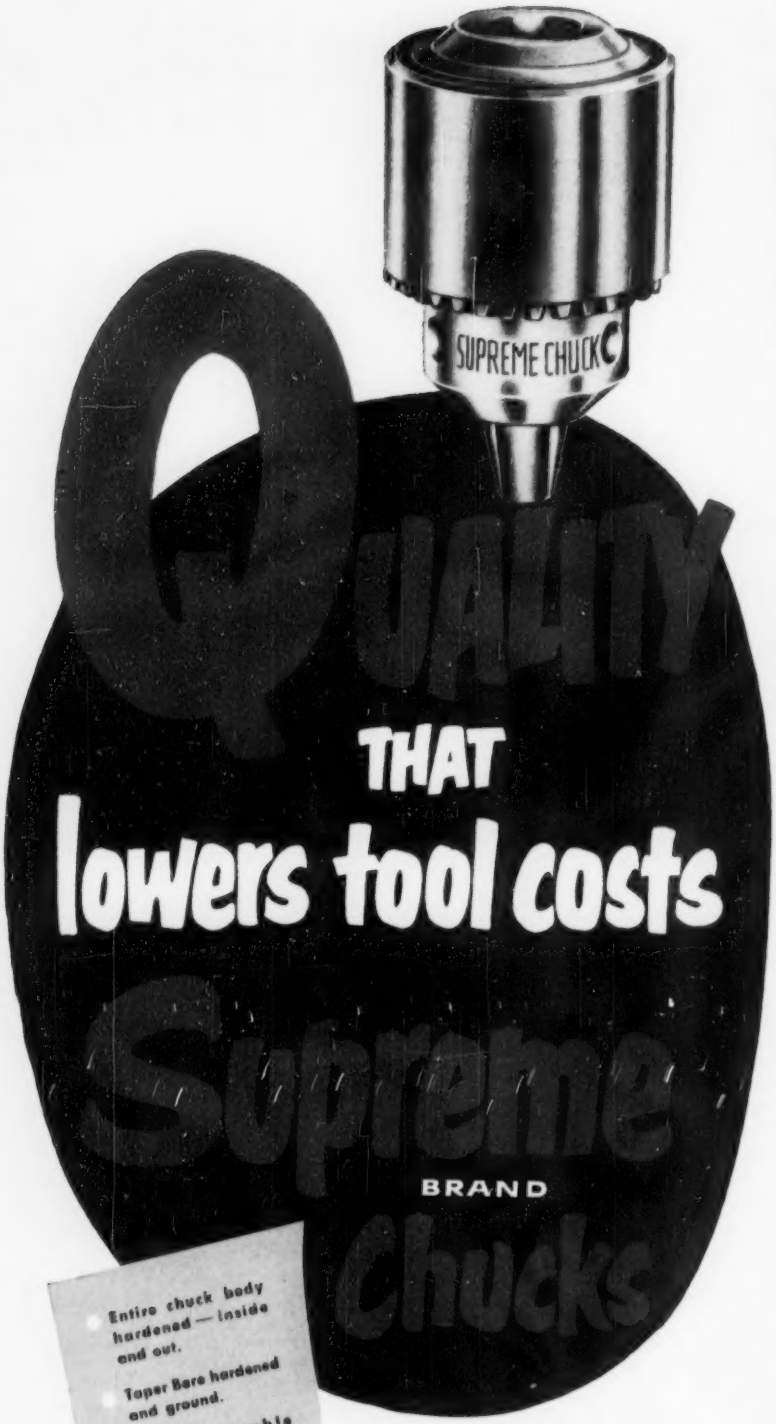

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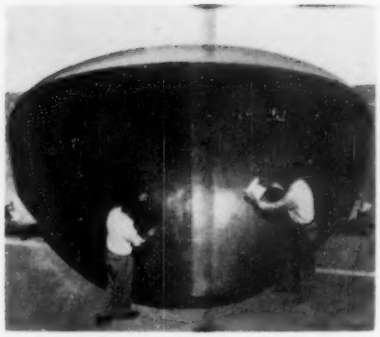
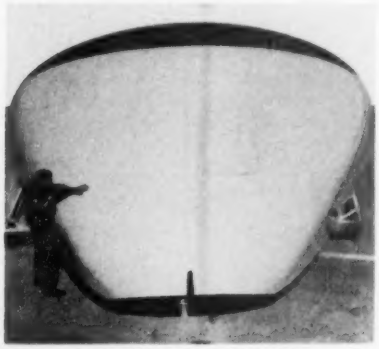


FRONT PORTION of radome has rain-resistant coating (dark portion).



REAR PORTION retains natural gray finish. Access panel is to right of center seam.

facilitates ground inspection of the radar equipment enclosed by structure.

A cutout in the aft half of the dome provides room for passage of the aircraft's wing flaps. Edge of the dome carries three metal attachment fittings for securing the structure to the aircraft. Small holes near the skin's edge accommodate pipe lines extending through the radome wall.

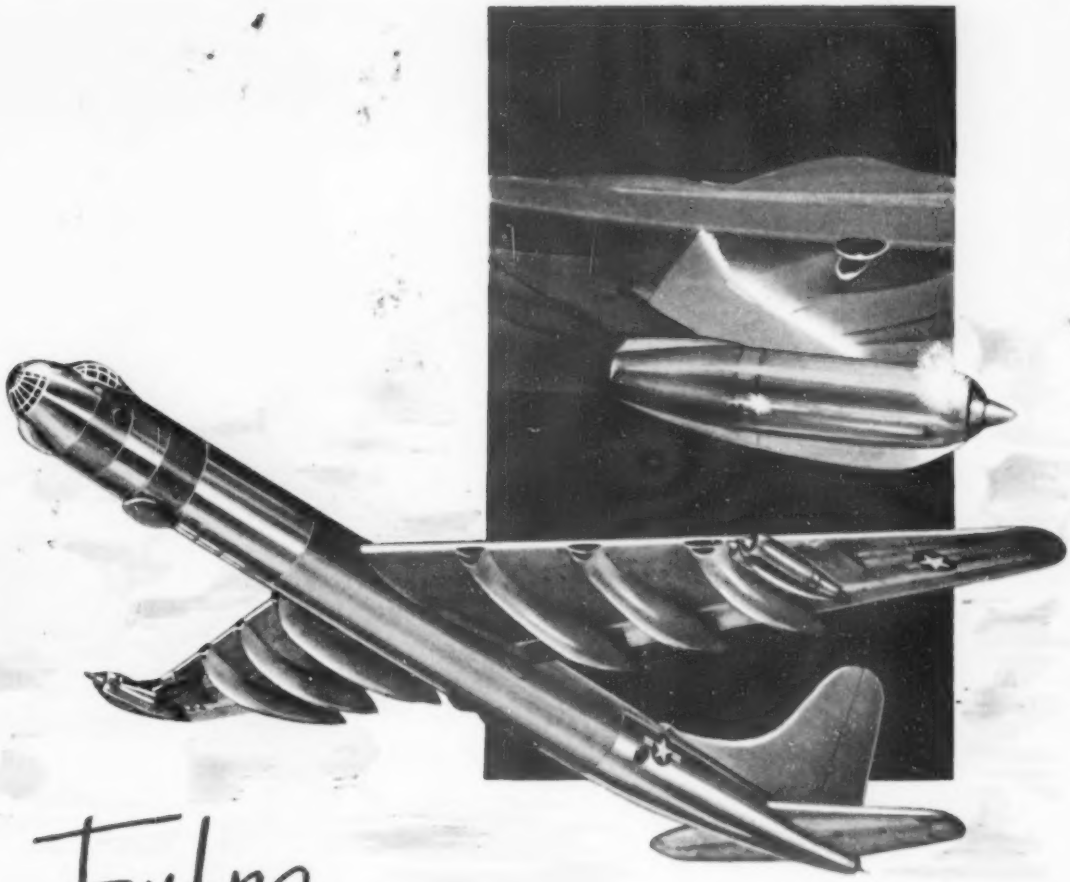
▶ **Mold Halves**—Mold for each half of the belly radome is a massive tool weighing about five tons. The mold proper comprises an aluminum shell backed by shell of reinforced plastic.

By a metal spray process the aluminum is deposited to desired thickness on a male form which has the exact contour of the finished radome. This metal shell is then backed with the plastic shell which has the mold-supporting substructure bonded to it with resin-impregnated cloth.

After the backing shell has been completely cured, the original form is removed and the aluminum facing is polished.

With the radome material in place, the mold and its supporting structure are wheeled into a large oven where heat plus application of pressure through vacuum results in the forming and curing of the part.

A considerable number of these giant radomes already has been made by Zenith and approved for use after electronic and static tests.



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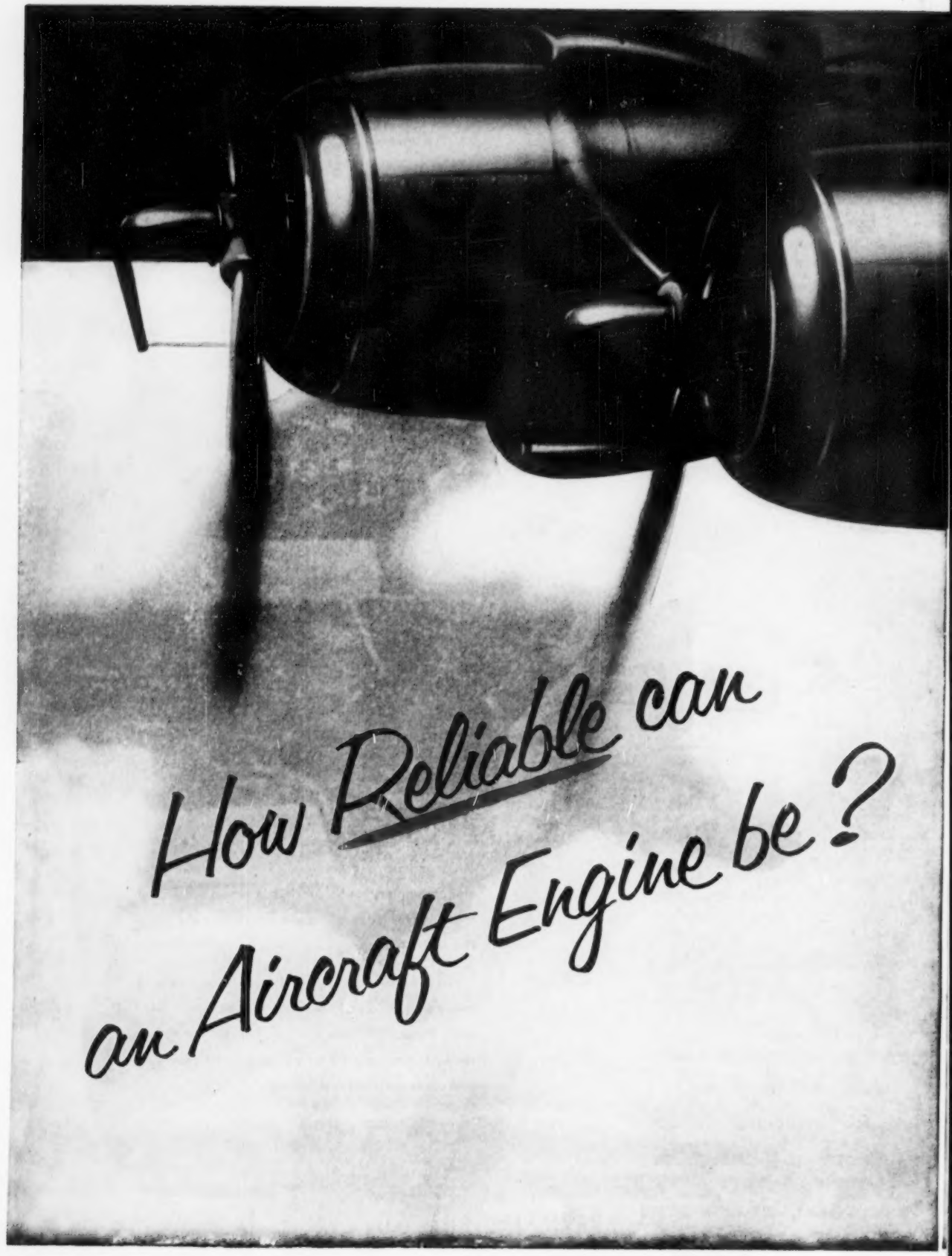
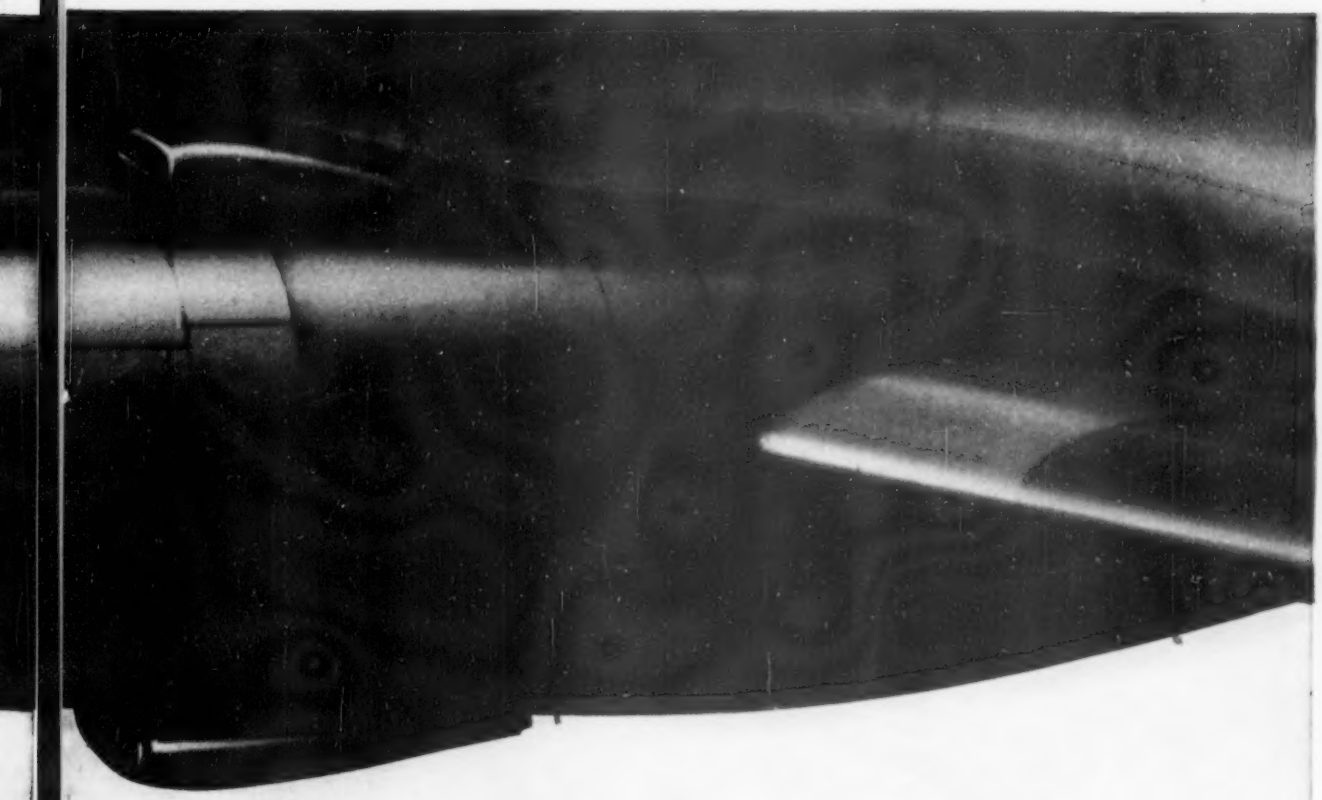

How Reliable can
an Aircraft Engine be?



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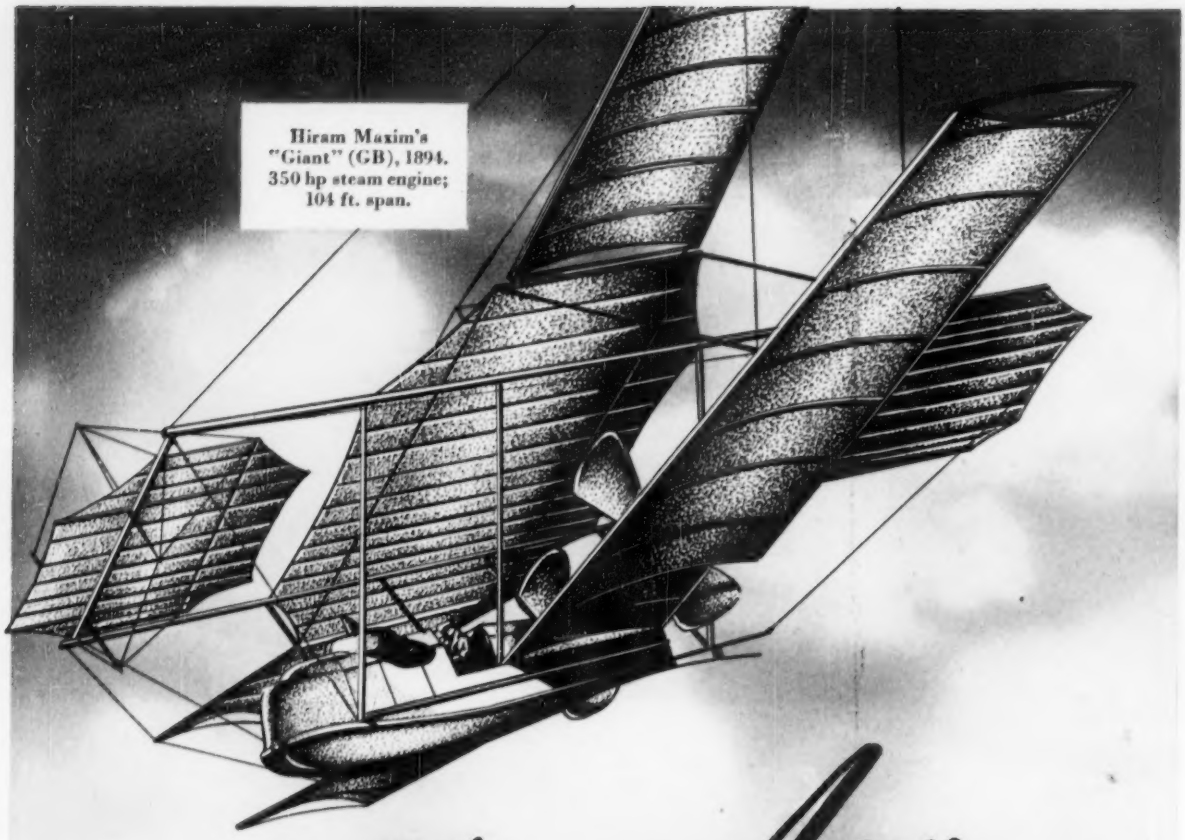
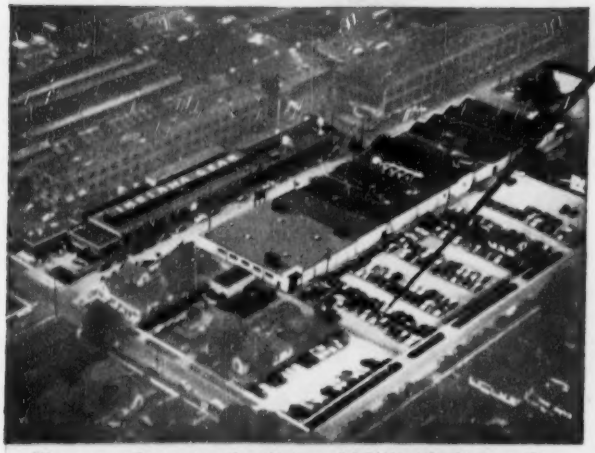


Hiram Maxim's "Giant" (GB), 1894. 350 hp steam engine; 104 ft. span.

...out of this came Aviation



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Sabena Banks on Helicopter's Promise

- **Fixed-wing operations benefit from copters as downtown-to-downtown service cuts travel time.**

By George L. Christian

Brussels—Belgium's national airline is celebrating its thirtieth anniversary this year with important strides forward in the fields of equipment and development.

▶ **First Copter Service**—Sabena (Societe Anonyme Belge d'Exploitation de la Navigation Aerienne), has taken delivery of two Sikorsky S-55 helicopters with which it has inaugurated the world's first international passenger helicopter service. Already connecting eight cities in four countries and flying some 1,400 miles a day, the service has proved so popular that the airline has had requests to bring its helicopters to six Belgian, four Dutch, three German and one new French town. And after only two months of operation, the two S-55s have carried over 3,000 passengers. Two more S-55s are on order.

Sabena will not deny the possibility of placing orders for Sikorsky's large twin-engine S-56 helicopter now nearing completion. The commercial version of the S-56 will have accommodations for 35 passengers and a crew of two under short-haul conditions, according to United Aircraft Corp. This will include allowance of 35 lb. of baggage per passenger (AVIATION WEEK Nov. 30, p. 11).

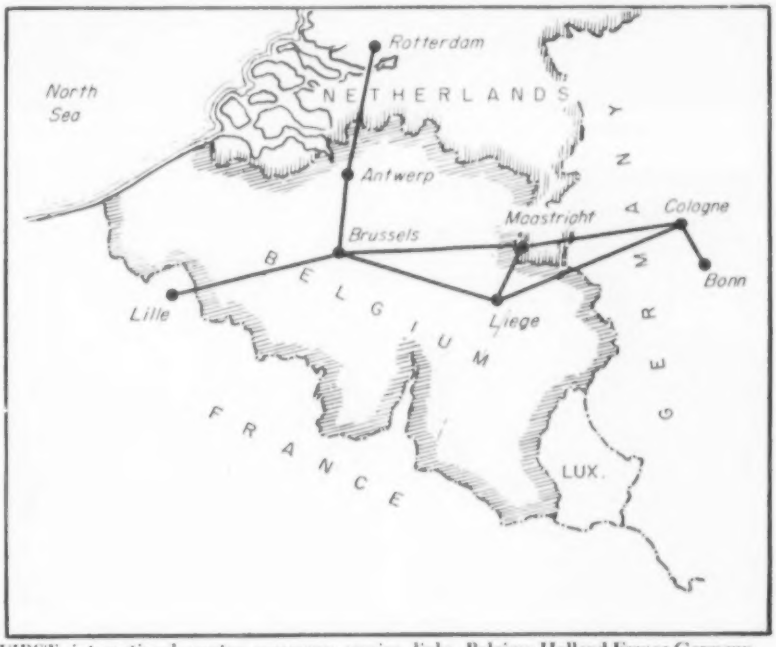
▶ **DC-6 Service**—Six newly delivered Douglas DC-6Bs have enabled the airline to offer both high-density tourist (72-passenger) and de luxe "Royal Sabena" (28-passenger) service across the Atlantic.

Operationally, Sabena is the first trans-Atlantic carrier to inaugurate direct, nonstop service from New York to Manchester, hub of England's highly industrialized Midlands. The acquisition of the DC-6Bs released the airline's DC-6s for tourist-class service to Leopoldville, capital of Belgium's Congo territory.

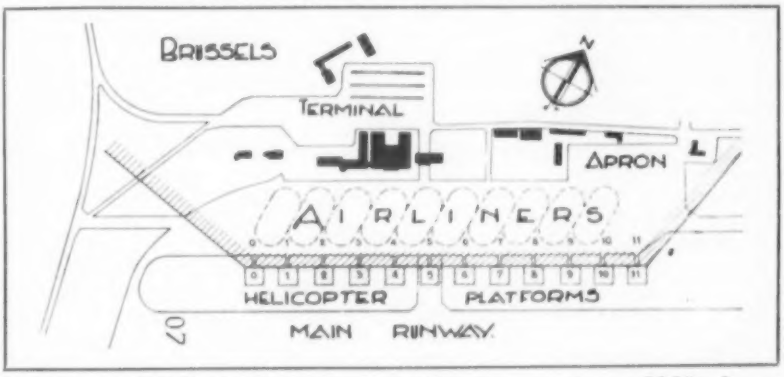
▶ **On the Ground**—Sabena's ground facilities at Brussels are growing under a vast expansion program. At Melsbrock National Airport, the line's ultra-modern overhaul and maintenance facilities will be enlarged with the erection of additional shops and hangars.

Downtown, Sabena's superb, $3-mil-

S-55 ROTOCRAFT TEAM UP with fixed-wing aircraft in Sabena's operations.



FIRST international copter passenger service links Belgium-Holland-France-Germany.



COPTER LANDING platforms adjacent to airliner area save time at Melsbrock.

BRUSSELS' MELSBROEK airport is Sabena's maintenance-overhaul center.

EXPANDED maintenance facilities include this 250x500-ft. hangar at Melsbroek.

ENGINE (left) and prop overhaul (right) are accomplished in these two shops.

lion air terminus is nearing completion. The modern, six-story structure, which faces Brussels' Central Railroad Station, will feature direct, nonstop rail service to Melsbroek Airport. The 15-minute ride will operate every quarter of an hour. Furthermore, helicopter-conscious Sabena had the building stressed to provide rooftop landing facilities for machines weighing up to 15 tons.

▶ **The Key**—Why so much emphasis on helicopters, especially by such a relatively small airline? A quick glance at a map of Western Europe supplies the answer. In a circle centered on Brussels, with a radius of slightly over 200 miles, live about half as many people as in the entire U. S.—about 75 million. Yet, in that densely populated area there are only five major airports: London, Paris, Brussels, Amsterdam and Frankfurt. Brussels is approximately at the geographical hub of these centers.

So the egg-beater emerges as sort of an ugly duckling, unlovely and uneconomical to operate at first, but promising a beautifully profitable future when larger and faster machines become available. They will soon be available—some having flown or being well along in prototype construction today.

Sabena is already well along with the problem of ironing out the many operational wrinkles which inevitably beset its untried type of rotary-wing flying at the outset. By the time the big machines become available, the carrier will have a substantial backlog of operational experience.

Anselme Vernieuwe, Sabena's vice president-operations (and holder of the first helicopter license issued to a Belgian) cites the advantage of a helicopter's ability to save time in the thickly-peopled 400-mile circle surrounding Brussels by landing in downtown areas.

▶ **Slower but Faster**—Sabena officials have evolved a new dimension in measuring flight times. When speaking of helicopters, they do not confine themselves to phrases such as "takeoff-to-touchdown," or "block-to-block." The new term "downtown-to-downtown" has emerged.

Here is how the 90-mph. S-55 stacks up against the 270-mph. Convair 240, both of which Sabena operates on the 120-mile run from Brussels to Cologne, on a downtown-to-downtown basis:

- **Rotary-wing** machine time, including two intermediate stops ..... 1:40 hr.
- **Fixed-wing** machine, nonstop—Downtown Brussels to airport ..... 0:35 hr.

Flight time (block-to-block) . 1:00 hr.
Airport to downtown Cologne ..... 1:05 hr.

Total time for fixed-wing . 2:40 hr.

So, in spite of being only one-third as fast as the Convair, the lumbering egg-beater slices almost a third of the total downtown-to-downtown time from the Convair's schedule.

Fastest express train time is 5:30. Cost of flying is approximately equal to first-class train fare.

▶ **Three Jobs in Future**—Vernieuwe foresees these three tasks for the helicopter of the future flying in what he calls "the best part of the world for rotary-wing operation."

- **Link cities** which, to date, have had to rely on surface transportation.
- **Replace fixed-wing** aircraft on short intercity routes.
- **Feed passengers** to fixed-wing aircraft at major airports. This function can also be reversed by timing helicopter departures so that passengers arriving on fixed-wing aircraft may continue to destination on the helicopters. This last feature is an important means of justifying the high cost of helicopter operation, since it has already been demonstrated during Sabena's brief experience with the machines, that they do bring passengers to airplanes who otherwise would have traveled via surface means.

▶ **Now Losing Money**—J. Naome, Vernieuwe's assistant, told AVIATION WEEK that helicopter operation would really

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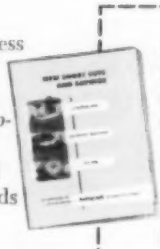

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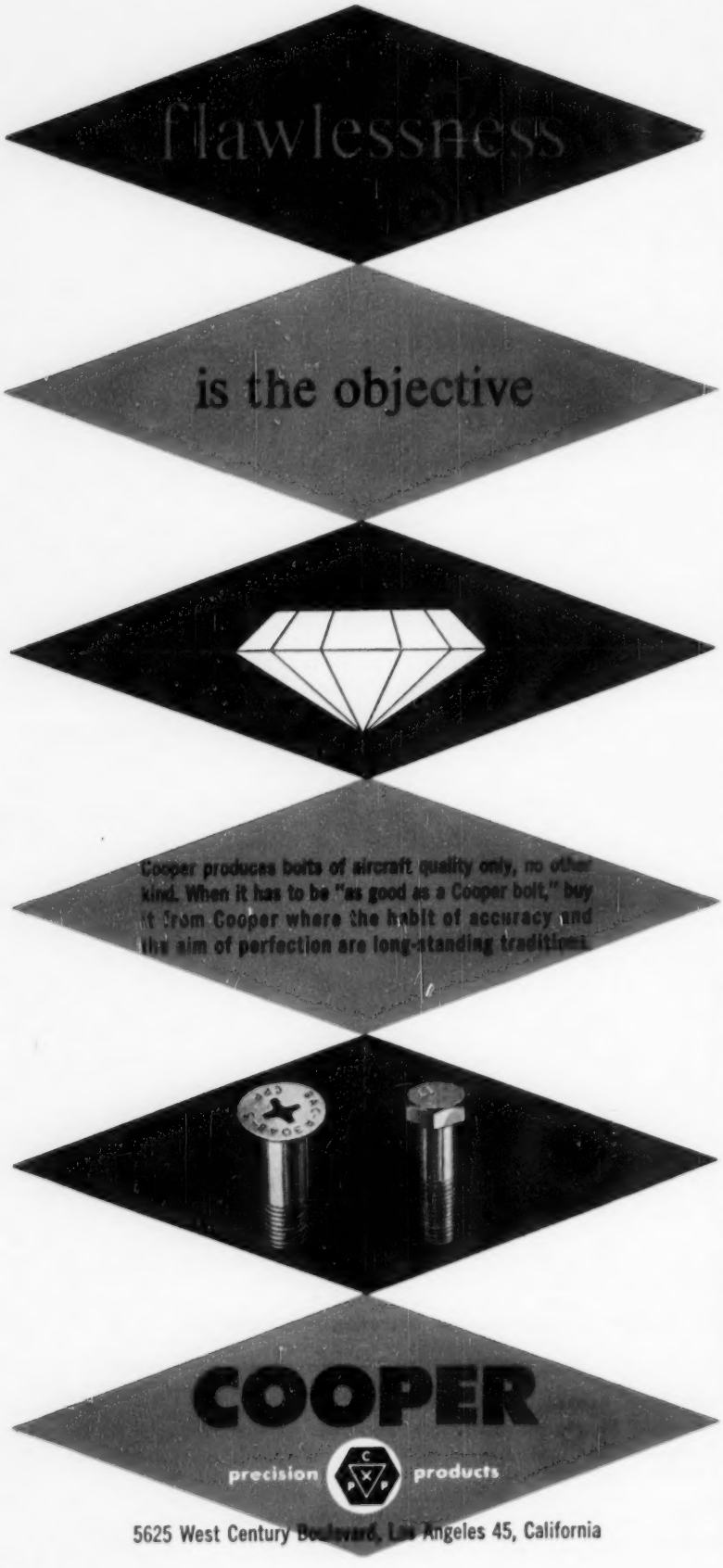
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come into its own when larger machines became available.

He conceded that Sabena was suffering a loss on its S-55 operation. But he suggested that the financial loss being incurred today might well pay off tomorrow in service rendered and operational experienced gained. Moreover, the cost of S-55s is not exorbitant, nor is the loss they are incurring beyond reason.

▶ **What Sabena Wants**—Sabena spokesmen outlined their needs for a profitable helicopter:

• **Twin engines** with single-engine performance for safety. This will also permit night flying and instrument operation, neither of which are now permitted for passenger flying. All flights are restricted to daylight, VFR operations. By making a helicopter capable of operating at night and during bad weather, its utilization will obviously be increased considerably. This, in turn, will contribute substantially to cutting the machines' operating cost.

• **Forty-passenger capacity** to provide sufficient seating for economical loads and mass transportation.

• **Fore-and-aft** entry and exit to permit speedy passenger loading and unloading. Such an arrangement would permit passengers to disembark at one end of the machine while others board at the other. This simultaneous loading and unloading would be a big help in accomplishing a "must" in helicopter operation—minimum ground time.

Right now, Sabena allows three minutes for its helicopter stops. A ride from downtown Brussels' heliport at Allee Verte to Melsbroek Airport proved the carrier sticks rigidly to schedule. And in this case, even in spite of heavy rain.

Sabena insists that future helicopters it buys be able to land in existing heliports, which measure about 500 ft. square. With such machines, capable of cruising at 125-150 mph., and operating from downtown locations, the airline's officials believe that the future of helicopters in their area is almost limitless.

Copter Operations

Here is an outline of the helicopter service Sabena is currently operating with its S-55s between eight cities in Belgium, France, Holland and West Germany. Here also are some of the problems, some of their solutions and some of the findings of Sabena's international passenger helicopter service.

▶ **From Mail to Passengers**—Sabena has been flying the mail in Belgium with first two, then three Bell 47-D1 helicopters for the last three years. So it was only natural to start the S-55s off as mail carriers shortly after their arrival.

S-55 mail service was started on Aug.

Remote electrical control opens or closes this new Fuel Shut-Off Valve in one second. Actuated by pump pressure, it provides high flow rate with low pressure drop by use of a single poppet fastened to a flexible Teflon diaphragm. Specifically designed for turbojet engine afterburner and rocket fuel feed systems, the valve is normally installed downstream from the pump. It has no close-fitting parts — handles unfiltered fuel acceptable to the pump. Aromatics in aircraft fuels do not affect the parts, and most rocket fuels do not corrode them.

In operation, fuel at pump pressure enters a chamber above the valve diaphragm through a filtered inlet bleed passage. Connecting the chamber to the downstream side of the diaphragm is an outlet bleed passage which closes when a solenoid is de-energized. Thus fuel pressure in the chamber holds the valve member in closed position. Energizing the solenoid reverses the action — holds the valve open. DC power failure closes the valve — operation is fail-safe. If desired, an alternate configuration provides for *opening* the valve should power fail.

Integral legs permit mounting to the structure and allow adequate work area for attaching piping flanges.

SPECIFICATIONS: Type 141 RL8 Fuel Shuit-Off Valve

RATED FLOW: 12,000 lbs./hr. at 15 psi drop. Valve size may be scaled for larger or smaller flow rates, as required. **PRESSURE:** 600 psi maximum. **OPERATING PRESSURE:** 2.5 psi minimum. **OPERATING SPEED:** 1 second opening; 1 second closing. **TEMPERATURE:** Minus 65° F. to plus 300° F. **POWER SUPPLY:** 17-30 volts DC, 1 ampere maximum. **MATERIALS:** Housing: Aluminum alloy. Diaphragm and Seals. Teflon. Valve Members and all other parts: Stainless steel. **CONNECTOR:** AN3102A-10SL-4P. **PIPE CONNECTIONS:** AND10086-20 flange fittings. **OVERALL DIMENSIONS:** Height 4-21/32". Width 6-11/32". Length 5-13/32". **WEIGHT:** 3-1/2 lbs.

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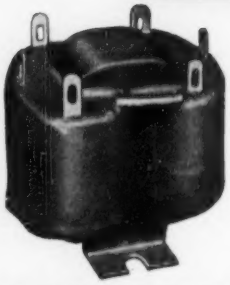

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3, passenger service was initiated shortly thereafter, on Sept. 1.

In three months of operating the S-55s, Sabena has been able to rack up these operational statistics with only two machines:

• **Utilization**—6:45 hr. per day. (Helicopters are operated only during daylight hours—7 am. to 7 pm. during the summer and 8 am. to 4:30 pm. during the winter, making this a relatively high figure.)

• **Mileage**—1,400 scheduled miles a day. In the three months of operation, the S-55s made only one unscheduled landing when a suddenly lowering ceiling forced a machine to land in an open field. No damage resulted. (This period includes foggy October.)

• **Load factor**—76.9%. Sabena thinks this is remarkably high considering the newness and uniqueness of the service. The 76.9% figure is calculated on the basis of 100% load factor equaling seven seats. Although the helicopters are equipped to carry eight, baggage usually precludes carrying a full passenger load.

• **Regularity**—87.9%. This figure is somewhat low because Sabena currently has only two machines operating. If one has to go in for maintenance, certain schedules would almost inevitably have to be canceled. And bad weather also plays an important part in keeping regularity down. When all four S-55s are operating, Sabena officials are confident that they will be able to improve considerably on the regularity figure.

• **Schedule**—Three trips a day from Brussels to Antwerp and Rotterdam; two round trips, Brussels-Lille; one circuit, Brussels, Liege, Maastricht, Brussels; one trip, Brussels to Liege, Cologne, Bonn and return via Maastricht. All flights are flown daily except Sunday.

Sabena enjoys cabotage rights within Germany, allowing the carrier to transport passengers between the German cities of Cologne and Bonn. It also has Fifth Freedom rights between Holland and Germany, meaning that it, a foreign company, may transport passengers between the German cities of Cologne and Bonn and the Dutch town of Maastricht.

▶ **How They Operate**—All S-55 operation is daylight VFR.

Visibility limits are 300 ft. and half a mile when flying over open country and 400 ft. and half a mile when operating over built-up areas.

When flying into and out of cities, helicopters follow open areas so that pilot is always in a position to land his machine in a safe spot in case of trouble.

Through cooperation with the governments of the various countries being served, Sabena was able to cut out all

Flight Tested!

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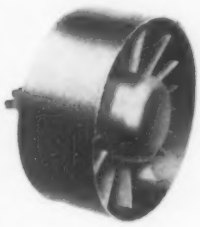
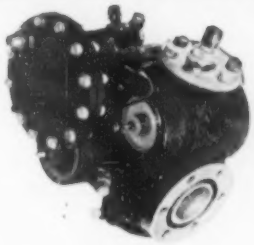
Marquardt air turbine accessory drives and thrust controls for missile and aircraft power plants are the outgrowth of more than 8 years of research and development.

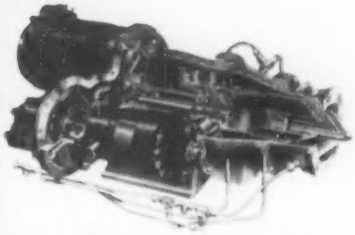
Marquardt, pioneer in ramjet and afterburner research and manufacture, has new engineering manuals concerning these illustrated accessories. We'll be glad to send you a copy.



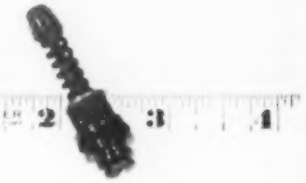
Ram air turbine driven unit for *emergency* aircraft power.



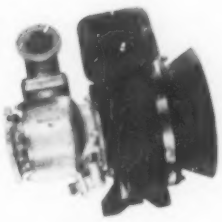
Supersonic ramjet engine power control.



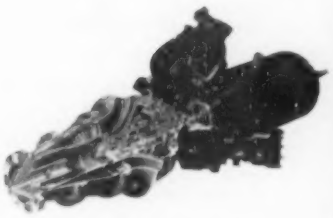
40 HP turbine driven unit, supplying electricity and hydraulic power.



Advanced design fuel nozzle for ramjets and afterburners.



Air turbine driven fuel pump.



50 HP turbine driven unit, supplying electricity and hydraulic power.

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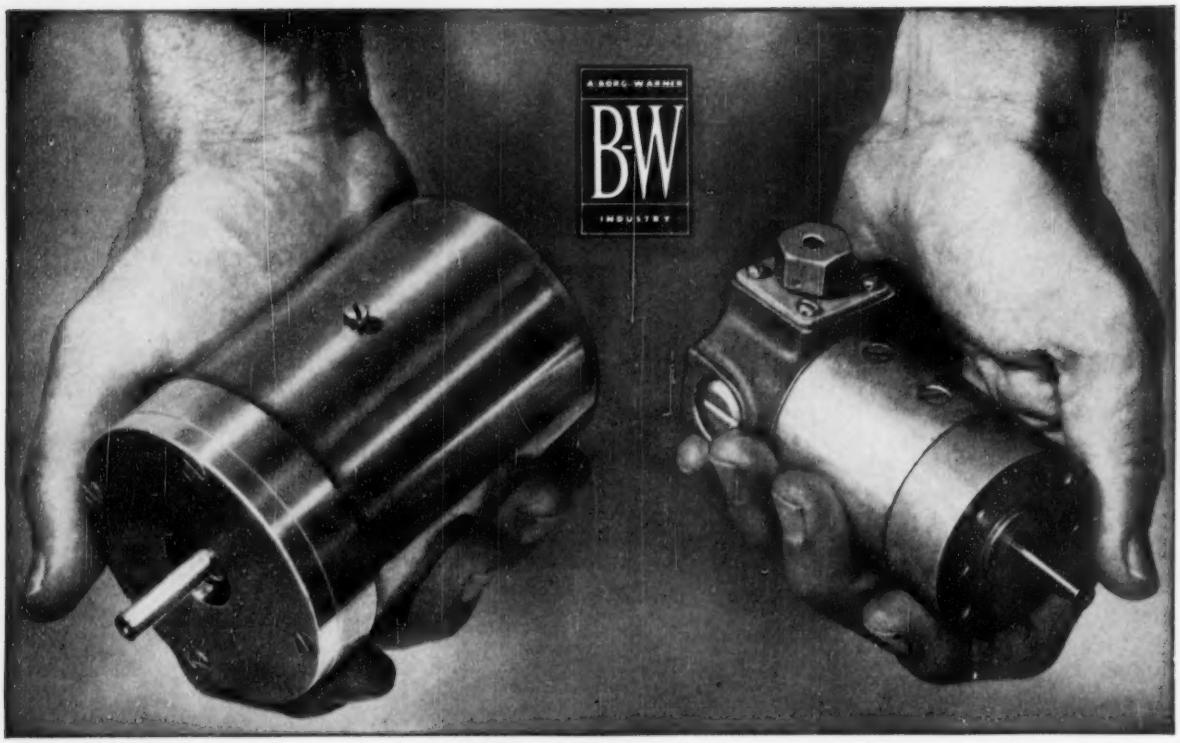

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Wherever you need electric motors for maximum power in minimum size, Pesco has the basic co-ordinated frame sizes and power elements you'll require.

For example—Pesco motors are now in use for: cooling (blowers for electronic equipment), tuning (radios and automatic finders), scanning antenna (civilian and military), antiaircraft radar fire control, as well as pump drives and mechanical actuators.

By using standardized parts in a series of six co-ordinated frame sizes, Pesco can provide you with electric motors for electronic applications with voltages from 6 to 120 volts D. C.; from 1/100 to 6 H. P. for operating speeds up to 15,000 R. P. M. Special, high-altitude design will operate from -65° to + 165° F.

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Motors in these frame sizes can be built for *your* specific frequency, using standard parts to obtain the speed and power rating desired. Consult our Engineering Department concerning your requirements. Strictest confidence—and no obligation, of course!

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SABENA SPRAYS DDT in Congo with government-owned S-51s on cost-plus basis.

paperwork connected with passenger manifests, embarkation and disembarkation forms, etc. Pilot handles only one piece of paper, called a Loadsheet. This shows him number of passengers and their destination, available payload, fuel load and the like.

Flights are operated without a co-pilot or flight attendant. However, passengers are not completely isolated from the pilot. A telephone is provided in the cabin, on the right side next to the loading door, with which the passengers may talk to the captain.

Sabena says the phone is very popular. Customers use it constantly to ask pilots questions about the countryside or about the machine. And in at least one case, it proved to be useful too. Due to an error on the Loadsheet, a pilot was overflying a stop, thinking he had nobody to disembark there. The passenger, noticing that his destination was receding in the distance, advised the pilot of his error. The helicopter was promptly turned around and the passenger let off at his proper destination.

Radio communications is a problem. The Belgian Civil Aeronautics Administration, RVA (Regie des Voies Aeriennes), controls all radio communications. Sabena cannot have a company transmitter with which to keep in direct contact with its helicopters. All messages have to be relayed through the control tower.

All heliports are linked by teletype to transmit load messages.

▶ **Inside the S-55**—Mr. A. Adam, Sabena's engineer in charge of helicopters, showed off these features of one of his company's S-55s undergoing a check in its hangar at Melsbroek.

• **Seats.** The eight seats in the S-55 were designed and manufactured by Sabena in their own shops. Feature is extreme lightness. Made of chrome-molybdenum, stainless steel tubing framework with padding and plastic covering, the seats weigh in at about 14 lb. each. Each is stressed for 4½G downward thrust, and 2G each for upward, forward or rearward force.

All seat backs are hinged to fold flat and parallel with the seats proper. These are the advantages: Folding the backs of the three rear, forward-facing seats allows access, through zippered panels, into the rear fuselage of the machine. Two middle, forward-facing seats' backs fold to allow easier access and exit to and from the rear seats. Three forward, rear-facing seats' backs fold to allow passengers to store their baggage in the space between seats and bulkhead.

• **Panel.** Sabena installed a cloth panel across the upper, forward portion of the cabin for the dual purpose of hiding the pilot's legs (for esthetic purposes) and bettering the cabin's soundproofing. Panel accomplished the first goal, failed in the second.

• **Rug.** A good, thick rug on the floor of the cabin is lined on the under side with a ¼-in. sheet of rubber. Purpose is to reduce noise and foot vibration during flight.

• **Phone.** The telephone installed in the cabin to allow passengers to converse with the pilot is proving to be so popular that Sabena is going to put another one on the opposite wall of the cabin.

Original installation used an aircraft type of handset on which a button had to be pushed each time the passenger wanted to contact the pilot. This was too difficult for the average customer and the setup was changed this way: lifting receiver from cradle actuates a microswitch which lights a light in the cockpit and simultaneously connects the phone to the pilot's jack box. If not otherwise engaged in conversation, pilot may select the "Cabin" position on the jack box and talk to the pas-

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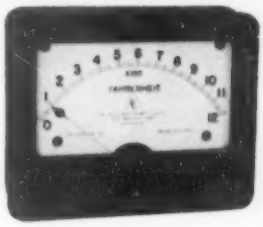
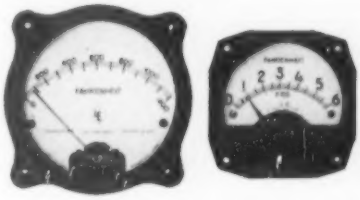


MODEL 58PY, above, has been used extensively by leading motor car manufacturers for road testing on the "Proving Grounds" — where performance counts. Housed in rectangular bakelite case, has 6" hand drawn scale and is fully compensated for ambient temperature. Made in ranges listed below, with suitable thermocouple materials.



MODEL 23B, left above, has same type movement as our aircraft pyrometers. Housed in flanged, 4" round, bakelite case for panel mounting.

MODEL 20B, right above, has same 3" steel case and same movement as our aircraft panel indicators. Both are fully cold-end compensated and available in standard ranges listed, with suitable thermocouple materials.

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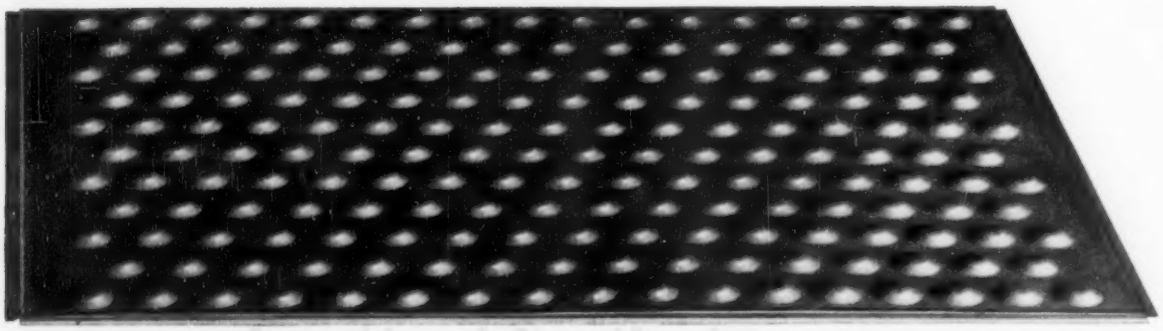
AN IMPORTANT NEW GEOMETRY FOR



HEAT EXCHANGERS

As the performance ceiling of modern aircraft continues to rise, extremes of temperature and pressure in heat generating and in heat exchange equipment create new and challenging problems.

Today's emphasis on heat transfer systems gives particular significance to Janitrol's most recent advance in this field: a new type of "dimple plate" construction which improves efficiency, saves weight, increases strength, simplifies manifolding, and opens a whole new geometry of design.

A complete heat exchanger can now, in effect, be laminated from identical, paper-thin stampings like that shown above. The sheets are welded in pairs, face to face, creating continuous passages for flow of air or liquid—each passage being at right angles to the next, and all passages manifolded in a simple economical design. The indentations increase rigidity of the assembly, facilitate fabrication, and at the same time accelerate heat transfer by creating a desirable turbulence in the flow.

Observe that this new lamination technique permits envelope configurations practically without limit. Now, a high efficiency heat exchange system can be squeezed into spaces previously unusable, and duct or piping connections greatly simplified.

If your heat exchanger problems involve increasingly high temperatures, high pressures, or special space restrictions, you'll do well to investigate this new Janitrol development. In fact, whatever your aircraft combustion problems, your Janitrol representative can place at your disposal Janitrol's thirty-seven years' experience in the manufacture of combustion equipment.

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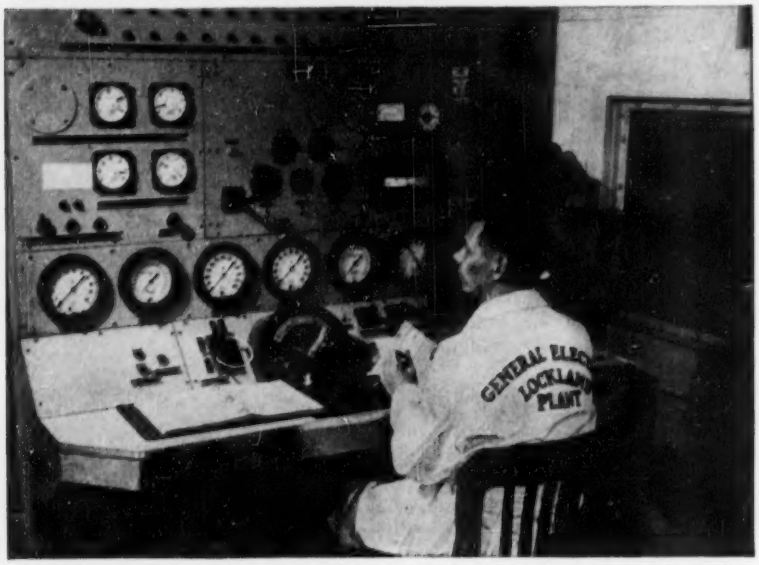
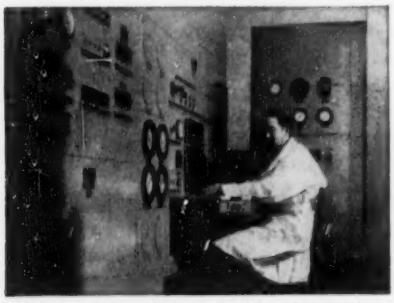
GREER TOPICS

Important News of Aviation & Industrial Test Equipment

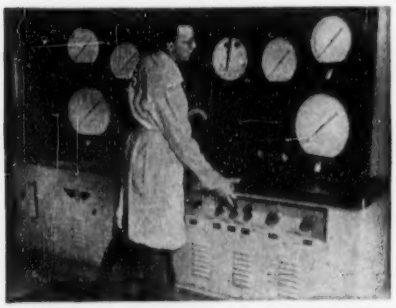


This photo shows instrumentation and control panels for testing the J-47 jet engine. GE engineer has an unobstructed view of engine under test through window at right.

Testing the J-47 Jet Engine with Greer Equipment



Another test cell for checking jet engines. General Electric test standards are among the nation's highest. Greer helps maintain them.



Shown here is the control panel for nozzle test stand. This, like other equipment shown was built in closest collaboration with GE.

Greer test machines used to maintain high quality control at GE engine plant

Why does General Electric use Greer test machines in checking the J-47 engine? Is it Greer accuracy? Dependability? Experience? It's all of these, of course, and more. Greer points to an unequaled record for service to the industry; a reputation that guarantees complete satisfaction; a list of customers reading like a "Who's Who" of the aviation world.

Pioneers in test equipment, Greer has more recently aroused industry-wide interest by furthering the standardization of test equipment. The Greer catalog (yours on request) will reveal a remarkable selection of standard units for a great variety of testing jobs, and Greer's staff of engineers can help solve your problem.

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senger. Passenger phone circuit is in parallel with the helicopter's VHF reception circuit so if the tower calls the pilot while he is talking to a passenger, he can hear the tower and cut the passenger off.

▶ **Mechanical Outlook**—Adam said that he had had very little trouble with either the S-55s or 47-D1s.

Concerning the S-55s (the two machines had accumulated 550 and 390 hr. respectively at the time of this writing), he said one of the nice features of the machine was the accessibility of most of the engine accessories such as magnetoes, carburetor and starter.

But the fuel pump is extremely difficult to remove, as is the ignition harness. Sabena is undertaking a modification to simplify replacement of the latter.

Sabena has installed all modifications required by the U. S. Civil Aeronautics Administration. These include a three-zone fire detection system (rear zone—electrical and heating; engine zone one—cylinder section; and engine zone two—accessory section); and positive cabin door lock controlled from the cockpit, which prevents the door from being opened until pilot actuates a release.

A consideration on the S-55s is main rotor clutch wear which requires clutch lining replacement every 200-250 hr. Clutch lining has tendency to wear unevenly, causing vibration. Only remedies are to rebalance the component or replace it. A clutch change means pulling the engine, according to Adam. Removing an engine and replacing it takes two hours elapsed time (eight man-hours), he added.

The three Bells also give very little trouble, Adam said. The machines, which have accumulated 2,500, 2,300 and 800 hr. respectively, are used to fly the mail and for pilot training towards the S-55s.

▶ **Bus Operation**—Sabena, like New York Airways, who operate passenger helicopter service with Sikorsky S-55s between the three New York airports, is trying to simplify its helicopter service as much as possible and treat it much like a bus service.

As mentioned earlier, paper work has been reduced to a minimum. All the pilot has to do is work with one, simple Loadsheet.

Passengers carry their own baggage on and off the helicopters. Baggage allowance is 10 kg. (22 lb.) per passenger except for those transiting to fixed-wing aircraft where their helicopter allowance is the same as that allowed on the airplane. Trans-Atlantic passengers, for instance, are allowed the full 30 kg. (66 lb.).

One of the helicopter's eight seats is almost always blocked to assure

Could It Fly Without Cherry Rivets?

Certainly!

Without any doubt, the fastest, piston-powered airliner—American Airlines' new DC-7 Flagship, could have been built (with some modification) without blind rivets. Cruising at 365 miles per hour in the quiet comfort of the luxurious cabin, you, as one of the 60 passengers on the nation's first *nonstop* transcontinental service, would never know the difference.

Yet, Douglas engineers will tell you that the thousands of Cherry Blind Rivets used in the DC-7 make it possible to accomplish fastenings which otherwise would be difficult or impractical. For example, the clean, aerodynamic design which contributes to the high speed of the DC-7 stems from the use of Cherry Rivets in fastening components of control surfaces and other streamlined sections.

The compact anti-icing units, the cabin heaters, the super air conditioning system are designed to eliminate bulk and excess weight. They involve many blind spots which are inaccessible for conventional riveting. Cherry Rivets help make these installations quickly, securely—unit costs are reduced.

Cherry Rivets are installed by one man from one side of the work by a special gun which pulls the stem into the hollow shank—upsets the end on the blind side—firmly clinches the rivet in place—fills the hole—all in a split second. Bucking is eliminated.

Cherry Rivets are but one group of the 10,000 types of fasteners and special cold-formed parts produced by Townsend in its several plants. As "The Fastening Authority," Townsend will help you speed production—produce better products—reduce costs by applying its method of manufacture to your fasteners and small parts. Special bulletins describing Cherry Blind Rivets and other Townsend products and services are yours for the asking.

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room for baggage, especially when a 30-kg. load is anticipated. Passengers are figured at a standard 75 kg. (165 lb.) for men and 65 kg. (143 lb.) for women.

▶ **Passenger Reaction**—Sabena has been distributing questionnaires to all its helicopter passengers ever since the service began. Duration of the program will probably be six months. Some of the questions asked are:

"If your journey ties up with a trip by plane, did the rapid and easy connection afforded by the helicopter induce you to make the plane flight? Have you already traveled by air? By plane? By helicopter? Supposing you had not traveled by helicopter, by what other means would you have made the same journey? By car? By train? By plane?"

Other questions: "Do you think helicopter travel is attractive? Why? Will you take the helicopter again for the same journey? Why? Was the journey on business? Private? What do you suggest could be done to improve the service?"

These are some of the reactions and findings tabulated by Sabena:

Passenger response to the questionnaires was excellent. Some 22% filled them out as compared to only 6% for fixed-wing aircraft.

Of the 1,600 passengers carried during September, the first month of operation, 85% were local passengers, traveling between cities, and 15% were transit passengers, using the helicopter to connect with a fixed-wing aircraft. It is interesting to note that 10% of the transit passengers were "helicopter transits," or passengers using one helicopter flight to catch another.

When broken down by passenger occupation, the statistics show this trend:

Of transiting passengers, 64% are traveling on business and 36% on pleasure.

Local passengers divide up 25% traveling on business and 75% for pleasure.

Of all passengers answering the questionnaire, 39% had never flown before. And of the 39%, 16% were transit passengers.

All this leads Sabena officials to believe that the helicopter is already fulfilling its primary objective. It is increasing fixed-wing traffic by bringing passengers to the airplane who otherwise would have traveled by surface transportation had not helicopter service been available to bring them quickly and conveniently to the fixed-wing aircraft.

▶ **Noise Problem**—Only complaint registered against the helicopter was about the noise in the cabin—some 26% of the passengers found it disturbing. However, as Sabena points out, there is not much that can be done about it. Principal culprit is the main rotor trans-

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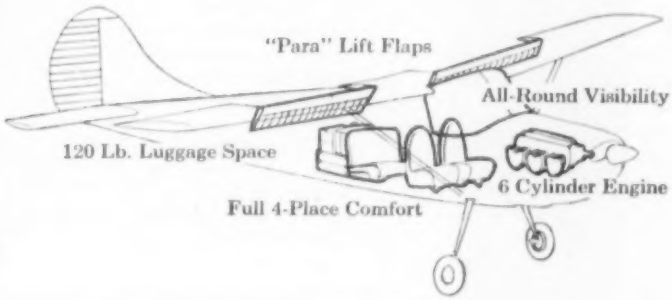
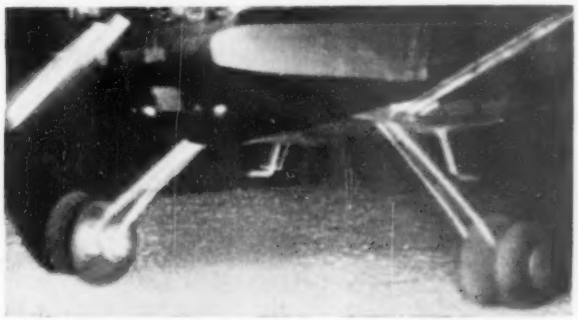


World's Safest, Smoothest Landing Gear



It "Flexes" To Absorb Shock

Superimposed high-speed photographs show how Cessna's exclusive landing gear flexes upward and outward to absorb the shock of rough-field landings and take-offs, provides a smoother ride for passengers, reduces strain on all parts of the airplane. No maintenance is required because there are no moving parts to wear out. For more information on Cessna airplanes, see nearest Cessna dealer (listed in yellow pages of telephone book) or write Cessna Aircraft Co., Dept. AW-12, Wichita, Kansas.

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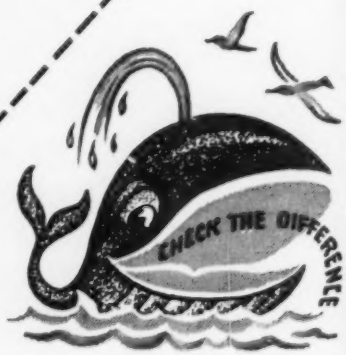
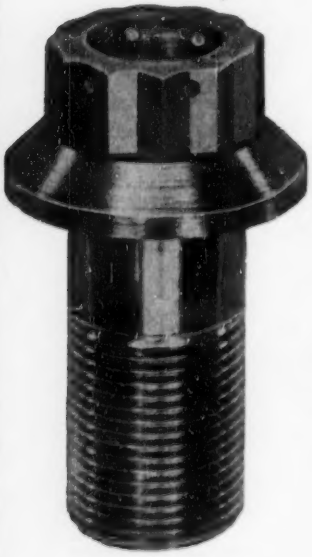
actual size of AN 123168





Lockheed special 725400

This Lockheed special No. 725400 is a special High heat treat cold headed bolt with P.S.I. of 180,000 to 200,000, with a diameter of 1⅞" at the shoulder and 1⅛" dia. at the threaded section. The head is 12 point. The radius under the head and the threads are rolled after Heat Treat to control grain flow for strength. This bolt has a very high fatigue percentage. Ground before Heat Treat because of no decarburization, thereby eliminating surface strain.

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COLD HEADED RIVETS AND BOLTS
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mission located in the roof of the cabin. About the only way to quiet this mechanism is to add a lot of heavy soundproofing, which is impractical.

In any event, noise in the S-55's cabin appeared no louder than average fixed-wing cabin noise, to this reporter.

Curiously enough, although Sabena' copters operate into the hearts of all but one of the cities it serves, the airline's officials say that "after over 6,000 landings and takeoffs, we have not received a single complaint about noise from the local inhabitants."

▶ **Free Heliports**—Sabena officials spoke in high praise of the "wonderful cooperation" they have received from the municipalities into which they operate their helicopters.

Most towns gave the land for the heliports and erected the small terminal buildings to Sabena's specifications at their own expense.

In Brussels, the heliport at Allee Verte is rented from a private organization. It is a five-minute walk from the North Station and the Place Roger around which are clustered many of the city's large hotels and principal shops.

At Melsbroek, 12 80-ft.-square helicopter landing platforms have been established adajent to the fixed-wing plane loading area. So, when a helicopter comes in with passengers for a connecting flight, the tower operator may direct the machine to a landing spot close to the departing airplane. Platform #2 is reserved for the mail helicopter.

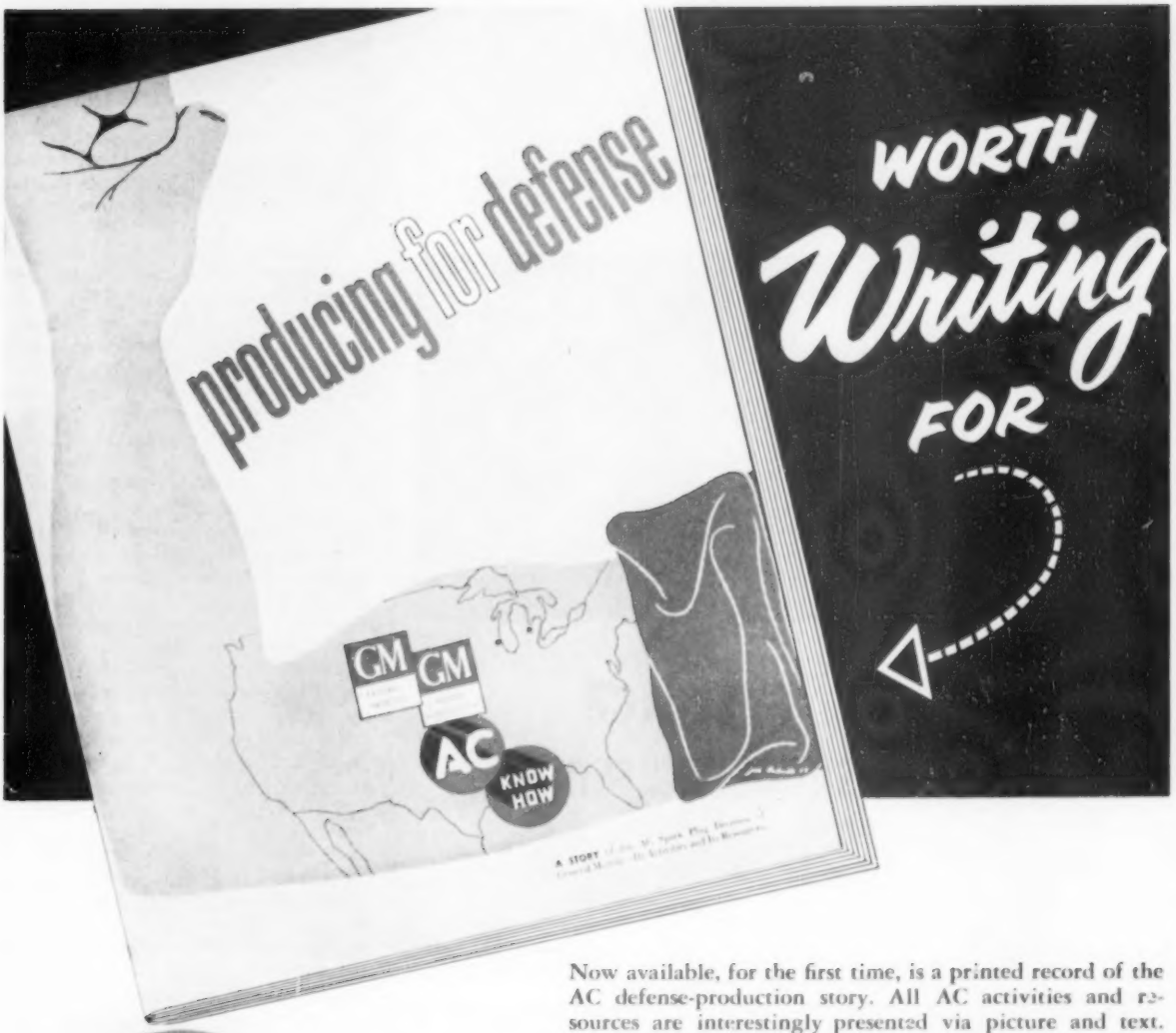
Almost everything is free. Sabena pays no rent, no landing fees and no fuel tax, at its downtown heliports, according to its officials. Practically the only expenses of operating a heliport are payments for light, heat and the station manager's salary. Normally, he is the sole employe at the heliport, being traffic agent, ticket clerk, loading agent, dispatcher and station manager all wrapped up into one. This inexpensive way of operating heliports contributes materially in keeping indirect costs down to a minimum.

(At the two airports which Sabena serves—Deurne at Antwerp and Melsbroek at Brussels—there is a landing charge imposed because all airports are under the control of RVA.)

▶ **Copter Economics**—This is how Vernieuwe outlined Sabena's cost calculations:

Direct cost of operating the S-55s comes to 35 Belgian francs a kilometer, or about $1 a mile. In direct cost is included fuel, oil, maintenance, spare parts, pilot's salary and amortization of the machine in five years with no residual value. A full load of seven passengers, charged 9 cents a mile, brings in 63 cents a mile for a loss of 37 cents a mile, with no indirect charges included.

Yet Sabena feels that the losses are



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HETHERINGTON Switches

not as severe as they appear on the surface because the copter service increases fixed-wing traffic and the airline's operations people, maintenance gang and pilots are piling up invaluable experience.

▶**Flying School**—Sabena was nudged into setting up a flying school by lack of qualified pilots to handle its expanding fleet of fixed- and rotary-wing aircraft.

Candidates are usually engineers taken right out of school. After "elementary" training, first on Tiger Moths and then on Saab Safirs, the fledglings decide between airplanes and helicopters. If the former, they go into DC-3s as co-pilots, from which they will eventually earn positions as captains of DC-6s. If the latter, they get 500 hr. on the Bells before checking out as co-pilots on the S-55s.

Autorotation experience on helicopters is assured through the practice of having pilots make an autorotation landing each time a machine is ferried back to the airport.

Sidelight on the Safirs: planes were delivered from Sweden with instruments calibrated in metric units. However, since the ships were going to be used to train pilots to fly American aircraft, instruments either had to be replaced with standard U.S. units or have the dials recalibrated to U.S. standards.

Sabena says it pays two-thirds of the school's cost, the government paying the remainder. The school has been in existence 1½ years, has trained about 40 pilots and is in its fourth session.

▶**Congo Copters**—Sabena runs a helicopter operation for the Belgian Congo Government. Three Westland-built, government-owned, Sikorsky S-51 helicopters are used to spray towns and villages with DDT in an anti-pest campaign. Results have been highly successful in curbing diseases spread by flies and mosquitoes, according to Sabena spokesmen.

Operation, which was started in 1951, is conducted on a cost-plus basis. Sabena flies, maintains and overhauls the helicopters for the government. Four pilots are used for the three machines.

▶**Mail & Training**—One Bell flies the mail in Belgium every day. Machine covers 453 km. (about 285 miles) serving eleven cities within the country. Other uses for the Bells are training and special flights.

Sidelight noted by a Sabena spokesman: Although the tail-boom coverings on the Bells add to the crafts' weight and are in no way useful to the operation of the machines, Sabena has found that they pay off in two ways. First, the sides offer an ideal spot to advertise the company and its pioneer helicopter operation. Secondly, the public thinks that the tail boom looks much more substantial with the covering—the

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4. It helps explain why Lockheed has an unequalled record of production stability year after year.

report on diversification at Lockheed

diversified development projects

The most diversified development program in Lockheed's history is under way—and it is still growing. Lockheed recently announced contracts for the highly advanced XF-104 fighter and a study of nuclear energy applications to aircraft. Other projects include work on jet transports and missiles.

diversified production

The result of diversified development in the past can be seen in the wide range of planes now in production. Huge luxury airliners, cargo transports, jet fighters and trainers, bombers and radar search planes are rolling off Lockheed assembly lines. Twelve models are in production.

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aerodynamicists "B"

jr. engineers (for aerodynamics work)

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thermodynamics engineers

thermodynamicists "A"

thermodynamicists "B"

jr. engineers (for thermodynamics work)

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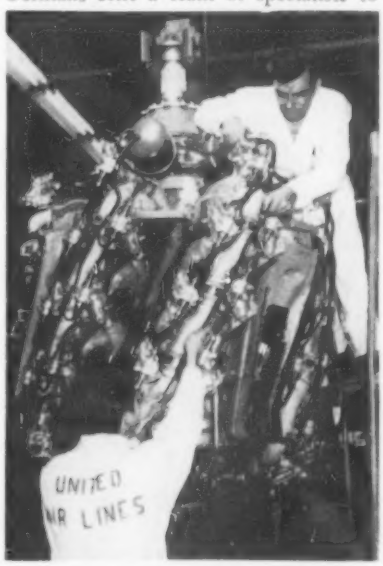
Sabena officials cite this example of the helicopters' ability to expedite mail delivery. Letters mailed in Liege in the morning reach Leopoldville, Belgian Congo in 24 hr. Distance is approximately 7,000 km. (4,350 miles). Helicopter from Liege makes connections with the Congo-bound plane at Melsbrock. Without this service, letters would take at least 24 hr. longer.

Ground Facilities

Sabena's modern maintenance facilities at Melsbrock were laid out with care and foresight. The airline's officials cite this compliment which they recently received from the revived German Lufthansa (now named Aktiengesellschaft fur Luftverkehrsbedarf). The Germans sent a team of specialists to



Resistant Harness

United Air Lines' mechanics install new vinyl plastic-coated harnesses on Pratt & Whitney R4360 engines that power the company's Boeing Stratocruisers. Advantages claimed for the new harness are increased resistance to abrasion and mineral spirit solvents, oils, greases, alkalis, acids and weathering. The vinyl will not support combustion. Used with the Scintilla low tension ignition system, the harnesses consist of an insulated conductor wrapped in nickel braid and covered with a nylon fabric which has been coated with Geon vinyl latex produced by the B. F. Goodrich Chemical Co.

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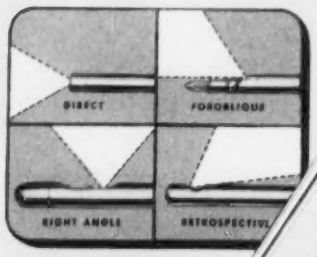

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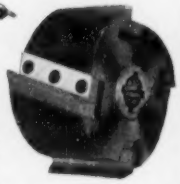

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look over the overhaul installations at many major European airlines. As a result of this inspection, says Sabena, the Germans decided to pattern their new overhaul set-up after Sabena's. Airline officials said that the Luftverkehrsbedarf group went through their shops with typical German thoroughness, measuring dimensions, taking inventories of machines and, in general, recording every detail possible.

▶ **Engine Overhaul**—Notes on Sabena's engine overhaul:

Engines going through the shop are Pratt & Whitney R2800s for the DC-6Bs, -6s, and Convairs; R2000s for DC-4s; R1830s for DC-3s and C-47s; and R1340s for Harvard trainers and S-55 helicopters. The shop is also handling a certain number of Wright R3350 Turbo Compound engines for Belgian Air Force C-119 Packets and R1830s for the USAF.

Overhaul time on the P&WA engines is standardized at 1,200 hr., and on the newer Turbo Compound time is now 800 hr. The R1340 engines used in the S-55s are going through at 500 hr. now—will shortly go up to 600 hr.

Sample man-hours required to overhaul engines are: 550 for the R2800 and 450 for the R2000.

Sabena has a good way of heating engine cylinders to remove valve seats and guides. Two cylinders simultaneously are held vertically in a jig over a gas burner whose flame is directed upward into the center of the cylinder. Flame is thermostatically controlled to maintain cylinder's temperature between 150-200 C. When properly heated, pulling a handle rotates cylinder 90 deg. to a horizontal position. While still in the jig, a mechanic knocks out the valve seats and guides with special tools. The pair of heating jigs can handle two cylinders every six minutes. Advantage is that mechanic does not have to handle hot cylinders. He works on one while the other is heating.

Sabena has just completed the construction of a 250 x 500-ft. hangar at Melsbrock. Interesting feature is the prestressed roof construction which allows for an unusually light, yet strong structure.

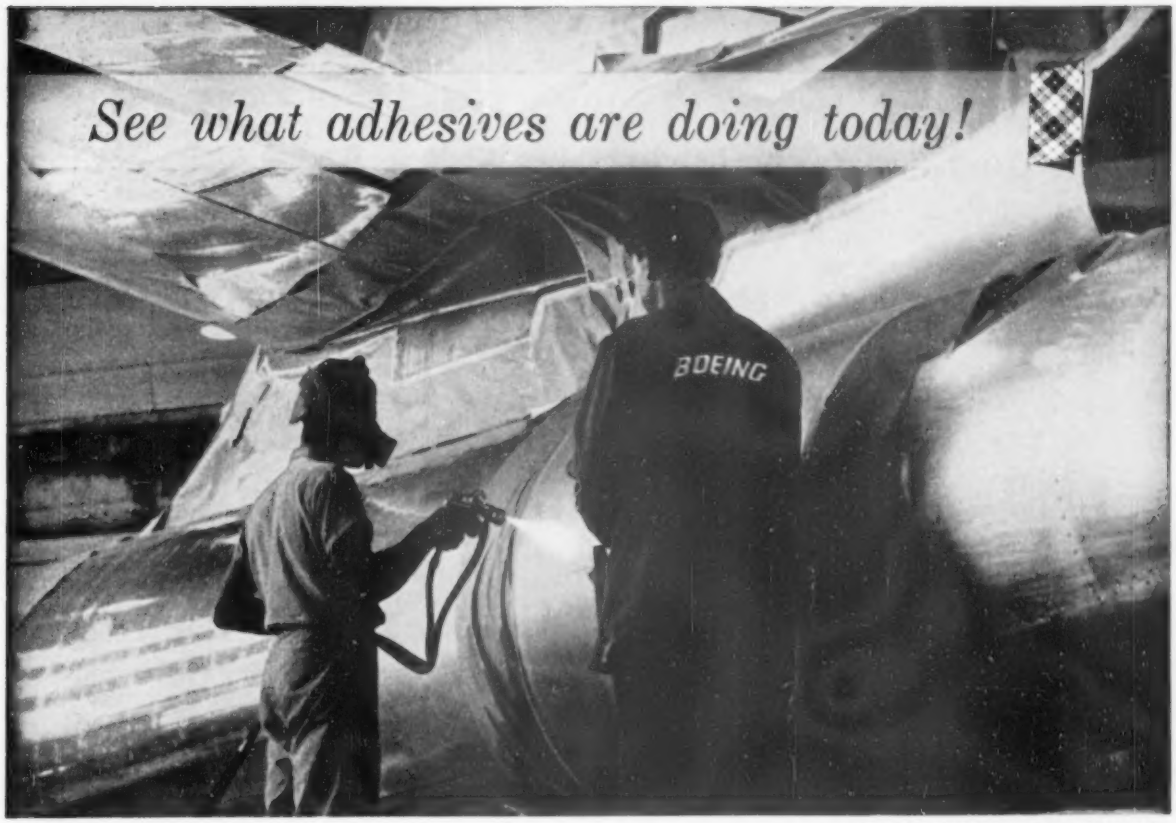
▶ **New Terminal**—Sabena's new downtown terminal is slated to open shortly after the turn of the year.

One building highlight is great accessibility to the airport. In the basement will be rail facilities which will speed passengers to Melsbrock in 15 minutes.

Sabena will occupy all the office space on the upper floors. Two ground floors (building is built on a slope) will offer space for ticket counters, offices, etc., for any airline desiring to use the facilities.

Capacity of the terminal is about 500 passengers an hour.

▶ **Into the Future?**—Sabena officials pre-



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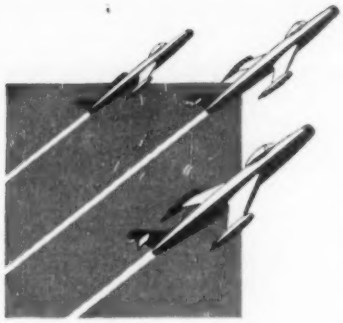

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dict that their lot will continue to be quite solidly cast with U.S. airframe manufacturers. They foresee the possibility of additional orders for S-55s and S-56s.

Why does Sabena lean to U.S. equipment?

Company executives answer: U.S. equipment on hand is giving excellent service and is built to last. Also, many components and accessories are interchangeable and common to all aircraft, greatly simplifying the problem of supply, not only at Brussels, but at more remote corners of the globe where the airline operates.

Another consideration: Sabena's equipment is similar to that operated by other airlines flying through common stations, permitting local lend-and-loan bargains which have helped cut mechanical delays away from home. Use of foreign equipment would greatly aggravate their supply and logistics problems, Sabena officials say.

OFF THE LINE

Flight Refueling, Inc., has started preliminary work on the site of its new 70,000-sq. ft. plant at Friendship International Airport, Baltimore. Location will permit bringing aircraft directly to the plant for test and installation of the firm's probe-and-drogue equipment. Plant is scheduled to be finished early next spring.

Trans World Airlines has purchased 13 complete AiResearch aircraft pressurization systems for Lockheed Constellations that are being converted to coach use. Equipment includes a compressor, cabin pressure regulator, rate of change and altitude selectors, temperature regulator, heat exchanger, safety valve and pressure switch. TWA has now purchased 32 such complete pressurization systems since it began converting its 049 Connies to high-density coach service.

Company planes can be operated for about the same cost as company automobiles, according to C. A. Benoit, Jr., 29-year-old president of Permatex Co., Brooklyn, N. Y. Benoit figures it costs him $15 an hour, or about 10¢ a mile to operate his 150-mph. Beechcraft Bonanza. Figure includes operating costs, depreciation and full insurance coverage for himself and three passengers. Plane is operated an average of 500 hr. a year or about 75,000 miles. By contrast, recent American Automobile Assn. figures show that a car in the $2,000 class, if driven 10,000 miles annually, costs about 9.16¢ per mile, including depreciation and insurance, Benoit points out.

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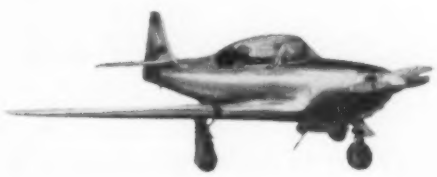

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When the North American F-86 Sabre Jet swoops in for a landing, two steel fingers control the landing shock. Like fingers in a dike, the pins meter hydraulic fluid through a small orifice to cushion the landing. Varied contour of the pin serves to vary resistance developed.

These pins are UTICA forgings, and point up an unusual development story. Under conventional forging methods, they would be expensive to produce because of immense machining required. Forging is practical only because UTICA has a "short-cut" production method for upsetting far greater than the standard three diameters.

They start by upsetting 15⅓ diameters

Each pin starts as a ¾" diameter, 21½" bar of SAE 4130. In one of UTICA's electrical upsetting machines 11½" is upset—*more than half the bar and, actually, 15⅓ diameters!* The bulb on the end is forged to rough shape, then machined to final dimensions. The UTICA forged part replaced the original part which was welded and required extensive machining. The new full-forged part has greater strength and requires much less machining. We are very proud the Cleveland Pneumatic Tool Co. picked UTICA Drop Forge for this important defense job.

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Third Annual Vickers Conference

Hydraulic Group Tackles Problems

High-temperature fluids are still in development stage, meeting hears; trend to Teflon seals continues.

By Frank Shea, Jr.

Detroit—Leading scheduled U. S. airlines and several foreign flag carriers were represented here at the recent Transport Aircraft Hydraulic Conference, sponsored by Vickers, Inc. This was the third such conference in an annual series which began in 1951.

Nothing dramatic or radically new came to light at the two-day session, but there was a lively exchange of views and information concerning the problems that worry hydraulic experts.

▶**High-Temp Fluid**—Work continues on high-temperature and non-flammable hydraulic fluids.

Monsanto Chemical Co. reported recent work along these lines still in the development stage; a fluid, classified as a high-temperature type, is available in limited quantities. In addition to Skydrol, Monsanto is developing a Skydrol 500 fluid. Whereas the former is a –40 fluid, the latter is a –65 fluid, according to MIL F7100, Monsanto said.

Hollingshead Corp. also has a high-temperature fluid, as well as advanced versions of H-2, under development, but is not yet prepared to give out information or samples, the company reported.

Union Carbide announced that development work was "essentially complete" on a new and improved water-base fluid for BuAer which Navy is in the process of evaluating in laboratory and bench-type tests. The fluid has not yet been flight-tested, but Navy should be doing something along these lines in the near future, Union Carbide said.

▶**Non-Flammable Fluids**—The airlines are not in complete agreement on the subject of non-flammable hydraulic fluids. American Airlines said its studies indicate that non-flammable fluids are "a pretty expensive proposition maintenance-wise," are heavier, more costly to handle, and "are not necessarily compatible with conventional aircraft materials." However, AA says its position in this matter is not necessarily firm or permanent, but will depend on farther developments.

But American has found that Skydrol does a "mighty good job" in the supercharger, and believes that the best place to use such non-flammable fluids is in the nacelle area, where the airline's studies show most fires originate.

United Air Lines feels that the safety values of a non-flammable fluid far outweigh the penalties involved in its use. Pan American and British Overseas Airways Corp. share this view.

Monsanto claimed that the expense of its Skydrol fluid was apparent only. Although it costs about $12.00 a gallon, it is good for at least 4,000 hours in the supercharger of the DC-6A, DC-6B or DC-7, for instance; when mineral oil is used, Douglas recommends it be changed every 250 hours. Monsanto also pointed out that pump replacement rate on units using Skydrol is far lower than on those using mineral oil.

▶**Effect on Seals**—The problem of the effect of Skydrol on rubber seals is being overcome, Monsanto said. The company has been meeting with various rubber manufacturers regarding butyl rubber seals, and the Society of Automotive Engineers has set up a subcommittee to write a specification for butyl seals. A progress report from the subcommittee is expected soon.

No airline seems to be considering the use of Skydrol in Constellation aircraft at present. However, Lockheed is evaluating the newer Skydrol 500 to determine its effects on the boost control valves, TWA said, and until the manufacturer issues a recommendation concerning its use, the carrier will not consider it.

▶**H-2 Experience**—UAL described its experiences with a DC-4 mockup equipped with Hollingshead H-2 fluid. Originally United had planned to equip six C-54 cargo liners with H-2, but ran into the problem of false fluid quantity indications. It was difficult to correlate the fluid level in the sight gage in the hellhole with the quantity indicator in the cockpit.

Hollingshead said that it had recently traced this trouble to foaming of the H-2, caused by the venturi-type pressurization system used in the plane. Removing the venturi eliminated the foaming and solved the problem, Hollingshead said.

There are at present no airlines flying with H-2, but the Civil Aeronautics Administration is operating three DC-3s with the fluid. Signal Oil Co. has racked up about 600 hr. with the fluid in a two-year period, and it is being used in a number of private aircraft.

A sample recently taken of the Signal company's H-2 shows little change in characteristics, Hollingshead reported, and the same is true of CAA's planes. There have been no indications of corrosion difficulties.

▶**Teflon Seals**—The continuing trend toward Teflon backup rings has lessened the problem of O-ring deterioration, the meeting heard. United felt this was especially true in regard to Skydrol applications.

Chance Vought has been replacing all leather backup rings with Teflon for the past two years, and is quite satisfied with the results.

Pan American, United and American have set up policies of buying O rings in individual, transparent, sealed containers bearing the description of the seal, its use and cure date.

Trans World Airlines has studied the possibility of packaging O rings in from one to 25 units, but feels there is little to be gained from this procedure. Results depend on how the mechanic handles the unit after it is removed from the package, TWA reported.

▶**Fixed-Displacement Pumps**—The question arose: What is the maximum that can be lapped on the wafer plate of the kit installed to reduce noise and vibration (by damping out pulsation) on the Vickers PF17-3911 pump?

Vickers said the size and location of

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the silencing and metering groove are carefully calculated, and to insure uniformity, a tiny hole about .020 in. in diameter is drilled in plate for the groove to run out into. Hole is located so that edge opposite groove is desired run-off point.

Ratio of length to depth of groove is about seven to one. It should ordinarily be permissible to remove .002 to .003 in. stock from face of plate and still permit groove to break into hole. If groove no longer breaks through, then too much has been removed, concluded Vickers.

Vickers said valve plates that had been over-ground or over-lapped could be repaired, but it was important not to go below the case depth of the hardened portion of the plate. If not more than .007 in. has been removed from the diameter of the plate, so the case hardening has not been passed, the O-ring groove may be reground to the desired depth, and the metering groove extended to the .020-in.-dia. hole. However, though permissible, it is not recommended.

A company representative said Vickers would be glad to issue a service bulletin to cover rework of valve plates that have become undersize as a result of grinding or lapping.

▶ **Link Bearing**—The size of spherical radius of universal link in the link bearing of the PF17-3911 pump is not too critical, Vickers said. Manufacturing tolerance for the 3911 and the larger sizes is ± .007 in.; smaller sizes have a little closer tolerance.

The Vickers spokesman added that concentricity, true sphericity and centrality with the flats are more critical. Relapping either length or bearings would be difficult without special tooling.

▶ **Coupling Shafts**—Coupling shaft failures in the PF17-3911 were discussed by the hydraulic experts.

United has started an inspection program on bronze shafts and Magnaflux on the steel shafts in the DC-3 pumps. These shafts are subjected to a limited number of runs, then are arbitrarily discarded. The carrier's failure rate has gone down by as much as 75% since initiation of the program.

Delta Air Lines has been using shafts for five runs, while American estimated that some shafts may have as high as 18,000 hr. on them.

Northwest has not had any shaft failures, changing shafts only on an "on condition" basis.

▶ **Wafer Kit**—General experience was that installation of the wafer kit in the Vickers pump increased overhaul periods.

Delta has extended the overhaul time on the pump used in the DC-6 to 5,000 hr. since the kits were installed. In addition the pump is functionally tested on each engine run.

United has applied to CAA to have overhaul time on the pump extended to three runs from the presently used

Road Show for Aircraft Tools

Toolmobile, a sales promotion vehicle of Aircraft Tools, Inc., Los Angeles, recently hit the road on a two-year tour of the U. S. and Canada. It is a converted standard airport bus, designed and rebuilt by Aircraft Tools at a cost of approximately $20,000 to demonstrate tools to aircraft manufacturers, subcontractors and the military. About 2,500 tools are displayed for inspection on one side of the limousine's interior. On the other side is a 12-ft. work bench equipped with 110-v. outlets, a drill press, vise, and a hot dimpling machine. Toolmobile carries its own compressor for adequate air supply, a 40-hp. air conditioning unit and a heating system for cold-weather showings. It also has a lounge for lengthy demonstrations.

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1929 In covered cockpit of his Consolidated NY-2, Jimmy Doolittle, using Sperry Gyro-Horizon and Directional Gyro, takes off from Mitchel Field, flies over 15 miles, and lands safely—accomplishing the first complete "blind" flight in history. Lieutenant Ben Kelsey acts as check pilot.

BLIND

FLYING... another Sperry first... 1929

"Blind" flying has an interesting history. For years many people had flown "blind" on occasion through clouds. And in 1926, William C. Ocker proved man's physiological inability to fly "blind" without instruments. His experiments, based on the Sperry-developed Turn and Bank Indicator, helped pilots understand and use flight instruments.

The era of dependable all-weather flying did not begin, however, until Lieutenant "Jimmy" Doolittle made his historic "blind" flight in 1929. With the aid of two new Sperry instruments, he opened the door to dependable all-weather flying. From then on a pilot had an *artificial horizon* on his instrument panel—a horizon that couldn't be blotted out by fog or darkness. And a *gyroscopic directional indicator* assured him of a precise course under all conditions, unaffected by magnetic disturbances.

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Twenty-four years have passed since the Doolittle flight. In those years Sperry has pioneered in development after development, utilizing electronics to make earlier instruments more precise, and to provide still greater mastery of the elements. With the Sperry Zero Reader* Flight Director, for example, military pilots now manually fly and navigate at supersonic speeds with accuracy and precision approaching that of automatic flight – and, with Sperry armament, intercept and destroy enemy aircraft unseen by human eyes. The Flight Director is widely specified for passenger planes and executive aircraft as well as for military use.

*T. M. REG. U. S. PAT. OFF.

1932 Captain A. F. Hegenberger in his Douglas BT-2A makes first solo "blind" flight and landing at Wright Field, Dayton, Ohio, using Sperry Gyro-Horizon and Directional Gyro. This flight was significant in proving a system of "blind" flying and landing and resulted in Captain Hegenberger's winning the Collier Trophy.

1936 Air Corps Major Ira Eaker, left, makes the first transcontinental "blind" flight—and alone—from New York to Los Angeles. His Boeing pursuit ship is equipped with Sperry Gyro-Horizon and Directional Gyro. Major William E. Kepner pilots escort plane.

1941-45

Sperry flight instruments enable U. S. Navy and Marine fliers to operate from deck of carrier, carry out missions and return—often in total darkness. Also, airborne radar helps pilots to seek out enemy aircraft and submarines.

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time of two runs. This means three times 1,600 hr. on the DC-6 and three times 1,300 hr. on the C-54. UAL will base check between runs.

American has the wafer plates in its Convair 240s and has increased the pump overhaul period to 3,900 hr.—three engine periods. The DC-6s do not yet have the plates, and their pumps are overhauled after two engine changes.

Eastern overhauls the pump with wafer plate after every second engine change—3,000 hr. on the DC-4 and 2,500 hr. on the 4-0-4.

Pan American is holding off on increasing pump overhaul periods until it works out a fix for the shaft grooving problem.

► **Variable-Discharge Pumps**—The operators discussed their experience with the AA-20500 variable-discharge pump series.

Delta stated that they have had much success with the shaft seal, noting only one unscheduled removal, with other units running 1,900 hr. Some operators reported that during Constellation flight, usually during cruise, the red pump warning light will come on. Before pump can be by-passed, light will go out.

Delta, Eastern and BOAC, which had experienced the problem, said they had not as yet been able to find a solution. Vickers could offer no answer either, stating that it appeared to be a circuit problem and not a condition within the pump itself.

Although Lockheed was not represented, Vickers volunteered information on the status of pump standardization for the Constellation-series engine-driven pumps.

AA-20510 pumps with serial suffix "E" or later will incorporate two additional studs at inlet flange side so that AA-20508 511 inlet flange with threads can be installed on that pump.

Vickers added that bulletin A-72 does include necessary information to rework AA-20510 pumps with serial suffix "D" or earlier, which were provided without additional studs. Pumps fitted with six studs at inlet side will now be able to use either the AA-20511 or the AA-20510 flanges, so that with the appropriate flanges the pump can be used on an L-479, L-1049 or on an L-1049C Constellation provided that its yoke position is limited to 21½ deg.

► **Yoke Reaction**—The new AA-20510 pump incorporates a design in which yoke reaction forces are reduced by improved valve plate silencing.

Vickers stated that the reduced yoke reaction forces would improve response of the pressure control by cutting the forces that resist the stroking piston in positioning the yoke. Also pump efficiency is said to be improved because

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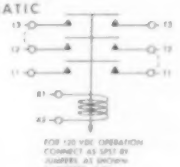

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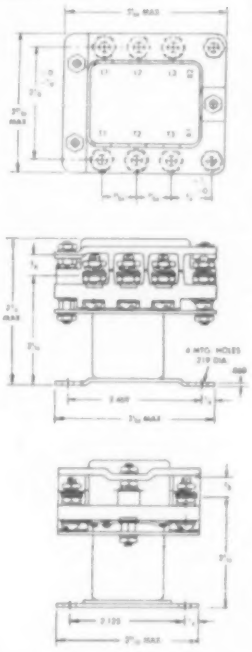

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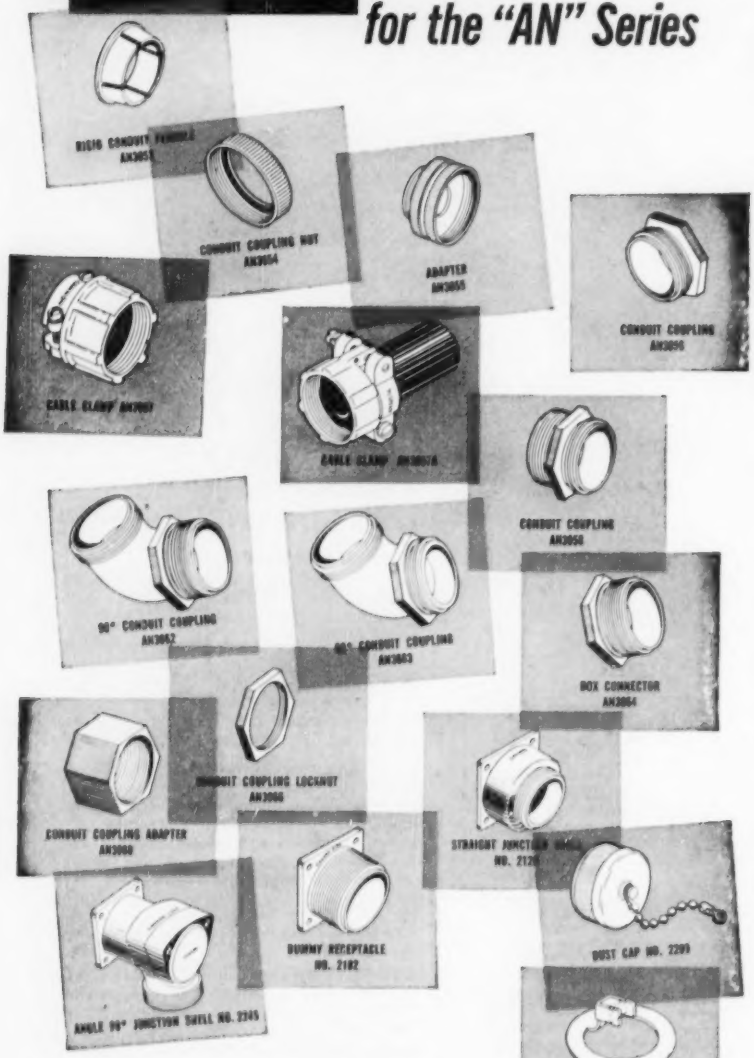

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the continuous bleed from low to high pressure is eliminated.

▶ **Pintle Seal**—Vickers stated that pintle seal failures in DC-6 Skydrol supercharger pump yokes have been eliminated in all AA and AS-35005 pumps by use of Teflon packing in place of O rings. Douglas originally came up with the suggestion, and Vickers has published bulletin A-88 to cover it.

American revealed that their main trouble on DC-6 superchargers has been difficulty with the V.D. pump, particularly around this seal. "We've heard quite a bit about the Teflon seal and its use in this location," said the American spokesman, "but recently we've heard a rumor that Douglas has more or less cooled on the Teflon seal." Douglas said this was strictly a rumor with no basis.

▶ **Electric Auxiliary Pumps**—The carriers discussed pressure settings for the Convair 340 emergency pump circuit.

Pan American stated that when the relief valve in the 340 system is set on a test bench for about 2,900 psi., in the aircraft under flow condition it goes as high as 3,100 psi. Valve cracks open at the right pressure on the bench, PAA continued, stating that they have now started to flow-check relief valve on the bench rather than set just the cracking pressure. They flow it at about 3.5 gpm.

Northeast and Delta stated that they have been using the recommended Convair settings and have had no such trouble on the 340. American revealed that presently their emergency pump goes through the system relief valve, adding that they are now putting in a separate valve in a revised system where valve will be set at 3,000 psi.

▶ **Fixed-Displacement Motors**—An unusual Vickers motor failure (foreground cooling fan) has been experienced. Four cap screws which secure the bearing retainer to the housing failed and allowed the rotating group to move out of position.

Vickers said that they had metallurgically examined the screws in question and that it was their opinion that they had been improperly heat-treated. Vickers is in the process of examining all screws of that type in stock to eliminate the bad ones.

▶ **Valves**—Pan American's Pacific Division has experienced difficulty in establishing the minimum cut-in, cut-out differential in the AA-34551 unloading valve.

The carrier's Latin American division noted that they were having the same trouble in Miami. It was felt the trouble has probably been due to new spare hydrostat units which they had tried to put in. Tolerance was not right, and rejected units have been sent back to Vickers.

Vickers stated that although they

had not as yet received the parts at the time they are returned they will be checked in a valve to see if it is a matter of tolerance and design.

Pan American's Pacific Division then added that after working with the problem for about six months they finally found it was a question of tolerances, and by lapping the hydrostat and spool assembly very slightly to increase internal leakage the problem was corrected.

► **Accumulators**—The meeting heard many complaints about the increased rate of failure of Bendix bladders and Vickers diaphragms in accumulators.

Vickers explained that it was probably a matter of quality control. Visual, or even chemical inspection, has not proved to be the answer, and now Vickers is actually cycle-testing diaphragms from each batch to get consistent quality.

The consistency angle was stressed by PanAm. "We don't care so much how long the bladder lasts. What we want is a bladder that will last a specific time and eliminate premature failures," PanAm's representative said.

Vickers felt that if properly stored, the shelf life of these components should be four years. Vickers destroys diaphragms that have been in stock over two years to insure that customers will get maximum storage life from the units.

However, diaphragms that have been returned by Navy for over-age—from seven to 10 years—have proved good as new in cycle-testing, the company said. Navy diaphragms are packed in cartons that are then enclosed in foil.

AA's representative suggested a meeting with rubber manufacturers in relation to accumulator diaphragms, similar to one set up last year to deal with O-ring problems.

Douglas said it is now recommending that the dual accumulator installation on its DC-series planes be considered optional. American, basing its decision on its experience with the Convair, which has only one accumulator, is ordering the DC-7 with a single unit.

► **Tube Fittings**—Weatherhead Ermeto flareless tube fittings got a number of boosts at the conference, although cautions were expressed in their use.

Chance Vought is using the Ermeto unit on the 3,000-psi. system of a military airplane, on both aluminum and stainless steel. Up to now, CV has made 100,000 assemblies (200,000 fittings) with a rejection rate of perhaps one-third that encountered with standard AN fittings. The complete airplane is impulse-tested to 4,500 psi. four times after completion. There have never been any blowouts of units after they have passed the series of impulse tests, CV says.

United, which uses the Ermeto

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Electrical & Electronic Control Systems			X
AC & DC Motors	X	X	X
Small Accessory Turbine Drives	X	X	X
Pneumatic Valves, Operated Electrically or Mechanically	X	X	
Solenoids, Intermittent or Continuous Duty	X	X	X
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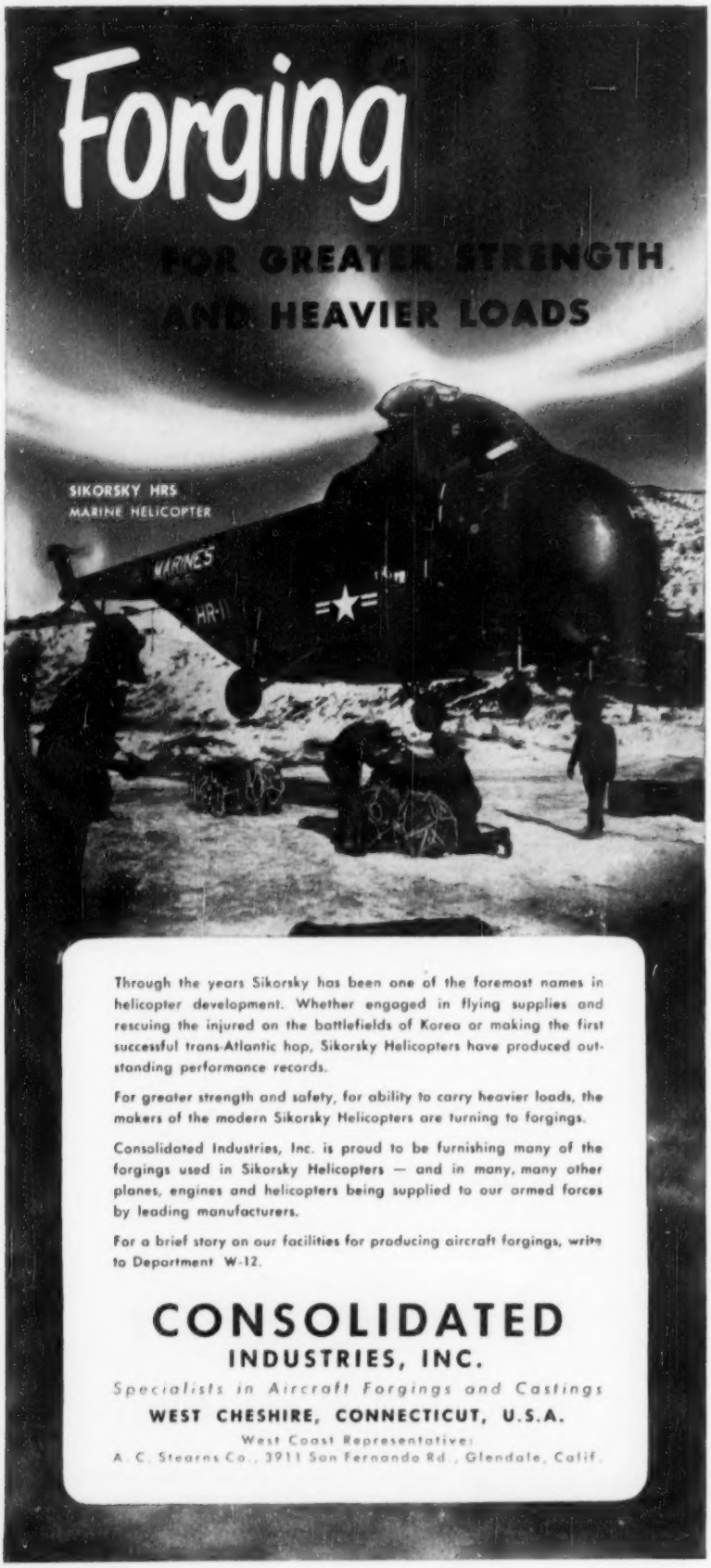
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For greater strength and safety, for ability to carry heavier loads, the makers of the modern Sikorsky Helicopters are turning to forgings.
Consolidated Industries, Inc. is proud to be furnishing many of the forgings used in Sikorsky Helicopters — and in many, many other planes, engines and helicopters being supplied to our armed forces by leading manufacturers.
For a brief story on our facilities for producing aircraft forgings, write to Department W-12.
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fitting on the 3,000-psi. Skydrol system in the Convair, found that it calls for an educational program with the mechanics. Instead of leaning on a wrench with all their might to eliminate a leak, the mechanics have to be trained to merely back off the fitting and retighten it. They must also be educated in presetting the fittings.

Trans World Airlines uses the Ermeto, AC and AN fittings, but prefers the Ermeto unit.

▶ **Tubing**—Opinion was divided on the question of welded vs. seamless tubing. Boeing and Superior Tube Co. pointed out that internal scoring may cause early fatigue failures.

Superior told the meeting that titanium tubing in welded and drawn form is available in a variety of sizes. Some seamless titanium tubing is also available.

There is still a good deal of work to be done, but Superior expects that seamless titanium tubing will be available in unlimited quantities in the next six months or so.

Boeing reported that it has started development work on titanium tubing and fittings for the Navy. Some flaring testing has already been done.

Douglas announced completion of a company study under USAF contract on the fatigue characteristics of stainless and aluminum hydraulic tubing and the effect of tubing quality and fabrication methods variables on fatigue life. The report, DEV-902, is available to qualified companies on request to Douglas Aircraft Co., Santa Monica, Calif.

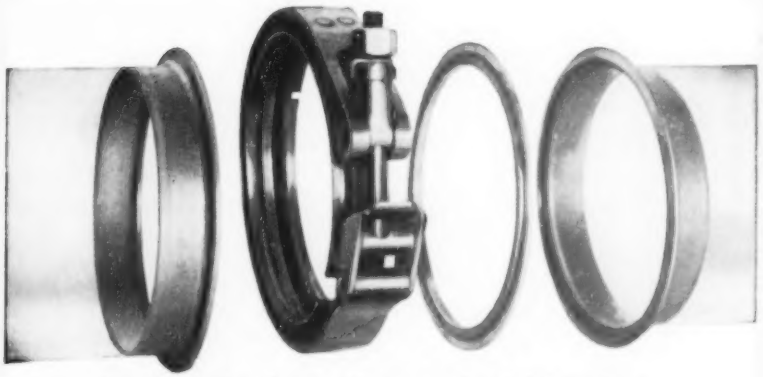
Toothpick Trick

This mechanic at Kelly AFB, Texas is saving USAF $1,173.31 annually. He is inserting round toothpicks instead of hand-carved wooden slivers into the 642 holes in a helicopter's main rotor blade where nails attaching fabric and abrasion strips to the rotor's leading edge have been removed. Toothpicks form plugs to hold new nails.

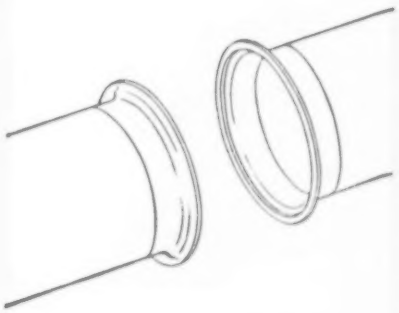
Lightweight LIVE JOINT SYSTEM

FOR HIGHER TEMPERATURES AND HIGHER PRESSURES

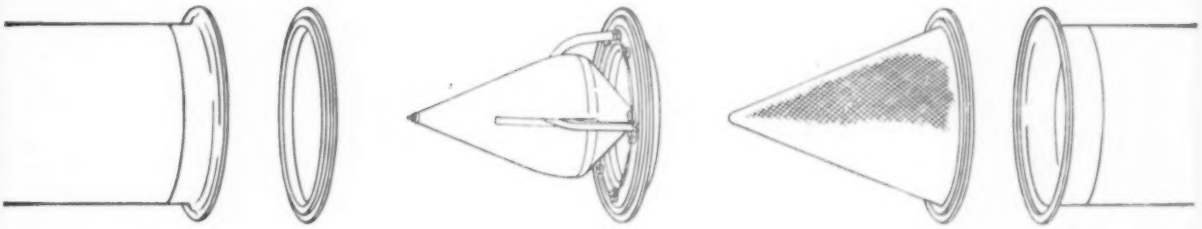
Completely new Marman live joint system speeds assembly—cuts costs—saves weight. It consists of a V-Band Coupling with integral stainless steel flanges. The unique design of the joint allows the introduction of a screen or check valve in the joint assembly without further modification.



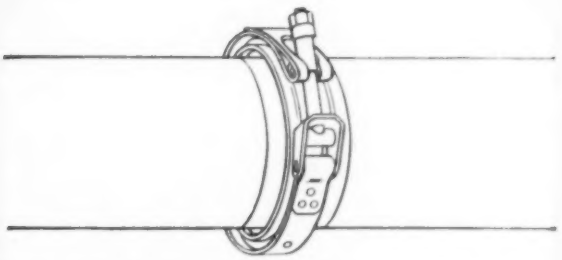
Components of new Marman live joint system.



1. Weld flanges to ducting



2. Insert metal self-aligning seal, . . . valves . . . . . or filters.



3. Assemble with Marman V-Band coupling for positive seal and dependable operation.

Easy to specify for quick delivery in a wide range of sizes—for information write Dept. W-5

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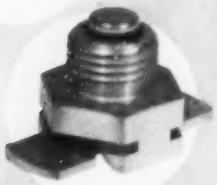
PRODUCTS CO., Inc.
11214 EXPOSITION BLVD.
LOS ANGELES 64, CALIF.

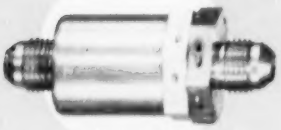
Patent Applied For

9-498

ALLEN AIRCRAFT
for dependability



SELF-LOCKING DRAIN VALVE
Straight or Pipe Threads



CHECK VALVE
Poppet Type

OXYGEN COUPLER
AN 6009-2A or -1B

PLAIN DROP TANK VALVE
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NEW AVIATION PRODUCTS

Solid Lubricant Coating Bonded to Metal Surfaces

A new film lubricant, Drilube, is said to be the answer to some of the difficult lubrication and corrosion problems of aircraft, guided missile and radar industries.

Drilube is a dry, flexible, solid-surface lubricant bonded to an applied surface. It is applicable to steel, stainless steel, brass, aluminum and its alloys, as well as rubber, some plastics and fabrics.

Drilube coating processes are designed for use on parts where bearing pressures or temperatures are beyond the capacity of conventional lubricants, and where the danger of scoring, galling or seizing exists, its manufacturer states.

Its special characteristics include high film strength, low coefficient of friction, tenacious adherence, chemical stability, and the ability to withstand extremes in temperature ranging from 100F to 550F and intermittent exposure to 700F.

Steel and aluminum surfaces are cleaned chemically and a phosphate corrosion-resistant coating is applied in preparation for the Drilube process. Stainless steel and brass are treated by use of a depassivating process.

The coating is then applied under regulated humidity and temperature conditions. Each coated part is cured by baking at temperatures which do not affect any previous heat treatment.

Among items for which Drilube is designed are machine gun and cannon blast tubes, servo units, universal joints, fuel cell outer surfaces and valves, catapult and rocket launcher components, and missile powerplant components.

Drilube Co., 723 West Broadway, Glendale 4, Calif.

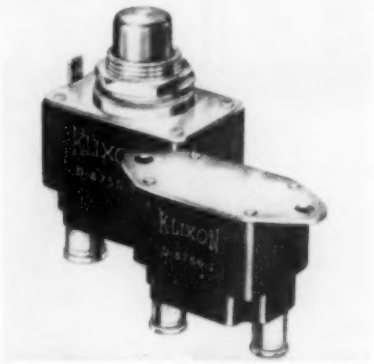
Aircraft Circuit Breakers Are Small but Rugged

New Klixon circuit breakers, in ratings of ¼, ¾ and 1 amp., are being offered by Spencer Thermostat Div. of Metals and Controls Corp.

Designated D6755-1 and D6756-1, the breakers are completely sealed for protection of power supply in aircraft instrument circuits. D6755-1 is the manual reset, non-indicating type, while the DC6756-1 is the automatic reset version.

Units are exceptionally small. Two D6755-1s will fit in the same mounting space used by one AN type push-pull circuit breaker, says manufacturer.

A snap-acting Spencer disk is the actuating element. Breakers are said to withstand shock of over 25G and a vibration frequency of 10 to 55 cps. with total excursion of 0.06 in.



Spencer Thermostat Div. of Metals and Controls Corp., Attleboro, Mass.

Low Hysteresis in New Measuring Instruments

A new line of scientific instruments for ground and flight investigations is being introduced by General Scientific Corp.

Included in the group are linear and angular accelerometers; displacement, pressure and differential pressure transducers; strain gages and vibration analyzers.

Units come in two types: An inductive type for use in a.c. circuits, and a "floating" strain wire type for use in either a.c. or d.c. circuits. Manufacturer is currently producing self-energizing and externally power-supplied models.

The instruments boast a number of new features. Suspension system is said to reduce hysteresis considerably. Interaxis coupling has been eliminated and elastic deformation has been reduced.

Manufacturer states that instruments have an accuracy 1% of full scale or better throughout a temperature range from minus 65F to 200F and a resolution of .05% of full scale or better.

Stated ranges are from .002G to 5,000G for linear accelerometers; 0.1 rad./sec.^{2} to 3,000 rad./sec.^{2} for angular accelerometers and .003 in./in. for strain gages.

General Scientific Corp., 603 North La Brea Ave., Los Angeles 36, Calif.

Selenium Unit Provides D. C. Anodizing Power

Completely self-contained selenium rectifier models to furnish d.c. power for electroplating and anodizing airframe and engine parts are being marketed by Rapid Electric Co.

In these units the three individual

phase controls have been replaced by single knob controls, eliminating the possibility of single-phasing when operated by unskilled workers.

Use of single knob controls is said to permit voltage and current changes in fine increments with no interruption. It covers the entire d.c. voltage range from 0 to 12 v.

Units are available in models ranging from 5 to 5,000 amperes and 1 to 60 v. output.

Rapid Electric Co., 2825 Middletown Rd., New York 61, N. Y.

ALSO ON THE MARKET

Surface plate made of black granite is being offered in small size for bench use. Known as "toolmakers flat," unit measures 8x12x2 in., weighs 15 lb., and is finished to an accuracy of 0.0002 in. overall. Price $22.95.—Collins Microflat Co., 2326 E. 8th St., Los Angeles 21.

Mounted abrasive points, known as Nu-Tex, feature soft grinding action that cleans, polishes and deburrs all types of metals and plastics in one operation. Bonded together with special resin, points eliminate need for hand operations such as filing, scraping, sanding and burnishing. Available in grade range from 0 (hard) to 5 (soft).—Atlantic Abrasive Corp., South Braintree 85, Mass.

Speed clamp, designed primarily to secure hoses to oxygen masks, also can be used to attach flexible connections to aircraft control systems, black-out suits, radar units and similar equipment. Unit can be applied on three different hose diameters, ranging from 1 to 1¼ in. can be locked from any angle with pair of pliers.—Tinnerman Products, Inc., Cleveland.

Push-button switches with moisture-proof and momentary-contact features are said to be ideal for use in machine gun and trim tab controls, and canopy, bomb and autopilot release mechanisms. Units may be ordered with variety of adapters to meet almost all mounting requirements. Types include SP-ST, 3-terminal or SP-DT circuit arrangements. Current ratings are 10 amp. resistive, 5 amp. inductive, and 3 amp. lamp.—Hetherington, Inc., Sharon Hill, Pa.

Thermocouple probe senses exhaust gas temperature of turbojet engine regardless of altitude, engine speed or temperature level, manufacturer claims. Unit gives faster response, is effective in minimizing errors of indication due to recovery, radiation and conduction. —Aero Research Instrument Co., 1901 No. Hermitage Ave., Chicago 22, Ill.

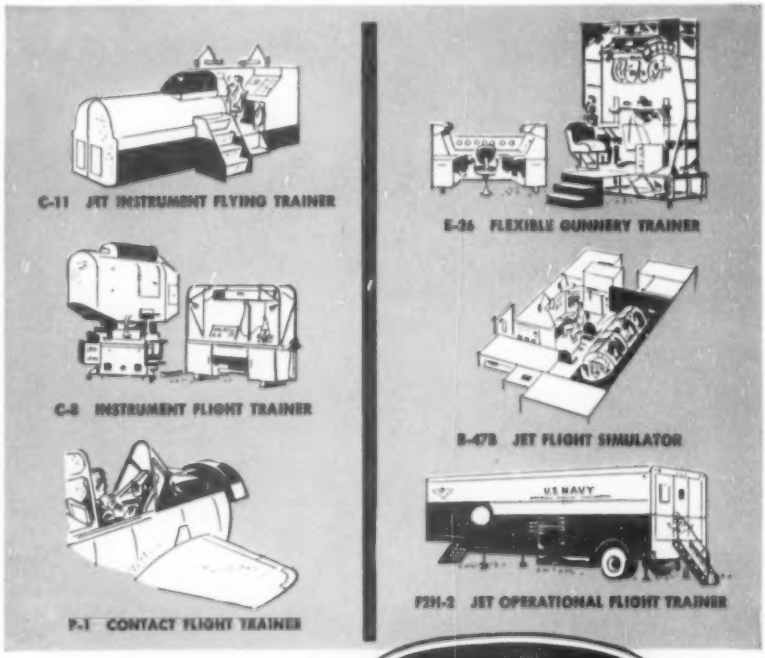
25 years of Synthetic Flight Training for AMERICA'S ARMED FORCES

As the air world expands so do the requirements for the complex electronic equipment that trains more pilots for the air age.

As 1953 draws to a close, LINK looks *back* 25 years with pride to its contributions...and *ahead* on the new and exciting developments yet to come.

This year, LINK was privileged to build and deliver a varied group of trainers and simulators to our Armed Forces and to our friends in aviation the world over. In addition to the delivery of these marvels of the air age, LINK in many cases furnishes the personnel to install, operate and maintain LINK equipment.

From the beginning of synthetic flight training, 25 years ago—LINK'S record has been one of constant pioneering and growth...determined to make America's Armed Forces *better trained—safer—stronger* for the air age yet to come.


C-11 JET INSTRUMENT FLYING TRAINER
C-8 INSTRUMENT FLIGHT TRAINER
P-T CONTACT FLIGHT TRAINER
E-26 FLEXIBLE GUNNERY TRAINER
B-47B JET FLIGHT SIMULATOR
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F2H-2 JET OPERATIONAL FLIGHT TRAINER

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ATA Issues Long-Range Forecast

Copter Outlook: Third of Air Traffic by '70

- **Intercity airline travel is expected to double.**
- **Association cites growth in battle for airport aid.**

By Lee Moore

Air travel among U. S. cities will more than double by 1970, Air Transport Assn. forecasts, and helicopters will fly a third of the intercity passengers by then.

ATA's predictions are submitted in exhibit form to the aviation industry's Airport Advisory Panel, which this month will make recommendations to Commerce Department concerning the recently suspended federal aid airport program of subsidies for municipal field construction.

Here are highlights of the ATA forecasts of 1953-70 increases in number of intercity passengers and tons of air cargo:

• **Scheduled domestic** fixed-wing transport passengers flown by U. S. carriers will increase 55% by 1970.

This low figure is explained by a prediction that scheduled airlines will use helicopters to take over most short-haul, intercity business, such as New York-Philadelphia.

• **Intercity helicopter** passengers will reach 6 million a year by 1960 and nearly quadruple that by 1970.

• **Scheduled international** fixed-wing passenger traffic of U. S. carriers will double.

• **Total U. S. scheduled** passengers, sum of the intercity categories, will increase from 32.5 million this year to 72.7 million in 1970, or about 125%.

• **Nonscheduled carriers** will increase their number of intercity passengers by about 115%.

This is based on an assumption that nonskeds will continue to hold their relative share of total business.

• **Foreign flag airlines** will increase their passenger traffic to and from U. S. by about 135%.

• **Domestic cargo** tons flown by U. S. carriers will grow more than three-fold.

• **International cargo** tons enplaned by U. S. carriers will almost triple.

• **Twenty-five ranking cities** will produce two-thirds of the passengers, just as they do now.

• **Fixed-wing aircraft** departures from the 25 ranking cities will increase from the present 1,111,300 a year to reach a total of 1,807,500 within the next 17 years.

This is a smaller percentage increase than there will be in number of passengers embarking and debarking at these airports, because each transport will be bigger, handle more passengers per flight.

▶ **Big City Business**—ATA selected 25 leading air traffic cities in the U. S. on the basis of number of passengers handled and volume embarking per air-

Airline Traffic Growth Forecast

	(1953-1970) 1953	1955	1960	1970
		(In millions)		
Fixed-wing passengers				
Domestic	29	35	39	46
International	3	3	4	5
Total U. S. scheduled	32	38	50	73
Foreign flag	0.3	0.4	0.5	0.7
Irregular	0.7	0.8	1	1.5
All passenger carriers	33	39	51	75
Helicopter passengers*			6	22
		(In thousands)		
Cargo (tons enplaned)				
Domestic	320	370	552	1,100
International	71	88	100	200
		(In thousands)		
Mail (tons enplaned)				
Domestic letter mail	23	26	64**	166
Domestic parcel post	26	42	70	124

*Excludes all helicopter traffic except non-commutation, non-airtaxi intercity passengers carried in multi-engine equipment.
**Assumes inauguration in 1960 of air service for all letter mail moving more than 1,000 mi., if space is available. By 1965, it is anticipated that the mileage factor will be reduced by postal authorities to 500 mi.
Source: Air Transport Assn.

Intercity Helicopter Passengers Through Fixed-Wing Airports*

	1960	1970		1960	1970
	(In thousands)			(In thousands)	
Miami	33	122	Denver	22	81
New York	174	610	San Francisco	59	215
Seattle	24	90	Cincinnati	21	76
Detroit	40	145	St. Louis	26	96
Los Angeles	75	276	Cleveland	32	119
Chicago	143	526	Portland	17	64
Minneapolis	25	93	Kansas City	24	87
New Orleans	20	73	Buffalo	16	59
Boston	32	113	Pittsburgh	32	116
Atlanta	40	145	Louisville	13	46
Houston	21	76	Memphis	13	48
Dallas	43	160	Philadelphia	16	52
Washington	79	291			

*Forecast is that this will represent only 20% of total intercity copter passengers.
Source: Air Transport Assn.

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THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it" — "they" being all the industry's front line of innovators and improvers—and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you — giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.

McGRAW-HILL PUBLICATIONS

Scheduled Airline Traffic At 25 Leading Airports

(Fixed-wing transports)

(Thousands of passengers)

	1953	1960	1970		1953	1960	1970
Miami	672	827	956	Denver	423	552	637
New York	3,314	4,234	4,778	San Francisco	1,124	1,478	1,684
Seattle	423	591	705	Cincinnati	409	512	592
Detroit	686	985	1,138	St. Louis	496	650	751
Los Angeles	1,431	1,872	2,161	Cleveland	590	808	933
Chicago	2,619	3,554	4,118	Portland	292	433	500
Minneapolis	438	630	728	Kansas City	467	591	683
New Orleans	385	496	569	Buffalo	321	410	464
Boston	657	788	887	Pittsburgh	569	792	906
Atlanta	774	1,005	1,138	Louisville	257	315	364
Houston	403	512	592	Memphis	251	331	378
Dallas	847	1,084	1,251	Philadelphia	350	394	410
Washington	1,472	1,970	2,275				

Note: *Estimates derived from independent appraisal of traffic at each airport. Main criteria: 1. Preservation of passenger trend with respect to airport's share of national traffic; 2. Declining revenue passengers per aircraft departure in view of prevailing high load factors and anticipated delivery of 226 additional modern aircraft during 1953-55.*

Source: *Air Transport Assn.*

Intercity Airline Traffic

	Domestic Fixed-wing	Helicopter*	International**	Total
	(Millions of passengers)			
1952	24.5		2.4	26.9
1953	29.2		2.8	32.0
1955	34.5		3.0	37.5
1960	39.4	6.1	4.2	49.7
1965	40.6	18.2	4.5	63.3
1970	45.5	22.2	5.0	72.7

*Includes multi-engine copters on non-commutation, non-airtaxi intercity carriage only.

**Assumes international jet service by 1960.

Source: Air Transport Assn.

craft departure. The latter figure of passengers-per-plane ranged in 1952 from an average of 24 in Miami, New York and Seattle to 12 in Louisville, Ky., 11 in Memphis and 10 in Philadelphia.

These figures are included in ATA's report to aviation industry representatives on the Airport Advisory Panel, most of whom urge Commerce Department to ask Congress to restore some kind of federal aid to municipalities who are interested in undertaking airport construction.

The panel, however, is hard put to agree on any single way that the proposed airport subsidies should be granted and administered.

Air Transport Assn., noting that the airports of just 25 cities handle two-thirds of all passengers, proposes that most of the airport aid be distributed to these heavy-traffic points as the most logical method.

▶ **Other Ideas**—But panel representatives of private fliers, business aircraft operators, local airport managements and state aeronautical offices have other ideas. They tend to favor spreading the airport subsidies more to the local airports.

The panel now is circulating a draft of an attempted compromise recommendation on airport aid, trying to come up with a unanimous report by Dec. 15.

Feeling is that if the industry cannot put up a solid front on how to grant federal aid to airports, it may not get any airport subsidy at all.

C-46 Operators Test Modified Commandos

Extensive tests of a specially modified and instrumented Curtiss C-46 Commandos are being conducted by Aircraft Engineering Foundation, Washington, D. C., cooperative organization of C-46 operators working on improving the plane's service and performance (AVIATION WEEK June 1, p. 23).

AEF has secured a C-46 fitted with torque noses on both engines with appropriate BMEP (brake mean effective pressure) equipment.

A Brown recorder for simultaneously

noting temperatures and pressures from either or both engines also is installed, as are simultaneous pressure recording manometers of both mercury and water gradation.

▶ **Training Program**—Meanwhile, The Foundation and Civil Aeronautics Administration have agreed on a joint C-46 training and technique standardization program, scheduled to get under way soon at CAA's aeronautical training center at Oklahoma City.

The Foundation will supply, operate and maintain the C-46 at the center. CAA will supply the training facilities and personnel.

CAA will give a two-week course to the 25 chief pilots of the Foundation's member carriers.

▶ **Forerunner**—CAA Administrator Fred Lee says he hopes this will be the forerunner of similar training standardization programs for other type aircraft. He adds that this program is in line with Administration plans "to place more authority and responsibility in the hands of private industry."

Each chief pilot on completion of the course will be designated an official "airline transport pilot examiner," giving him authority to pass on to his crews the C-46 techniques learned.

During the course, pilots will learn performance capabilities and limitations and the "most scientific" way to handle the C-46 in various normal procedures and unusual situations, CAA says.

Blatt Lists Aviation's Key Lighting Issues

Ten key problems in aviation lighting, "a crucial factor in aviation safety," were outlined recently by Joseph D. Blatt, assistant administrator for program coordination, Civil Aeronautics Administration, in view of the more than 15 million landings and takeoffs handled by CAA control towers in a year's time.

Blatt spoke before the Illuminating Engineering Society. The 10 problems, he said, are:

• **Development** of effective means for avoiding collisions requires concurrent work on both aircraft external lighting and on improved vision from the cockpit.

• **Clear, bright daylight conditions** create the most serious collision hazard.

• **Basic physiological** and psychological data urgently are needed to provide standards for external aircraft lighting.

• **Increasing use** of special types of aircraft, such as helicopters, requires that they be equipped with special lighting arrangements.

• **2,000-ft. television towers** are being erected which are practically invisible even in daylight. They must be made more conspicuous through proper lighting.

• **Runway guidance** lighting must be improved and standardized. Direction and intensity of their beams must adjust themselves to the visibility conditions. They must continue through runway intersections which will require a flush-type light.

• **Pilots must be warned at night** if they are running out of airport while taking off or landing. Distinctive lighting at the far end of each runway is required.

• **Runway threshold lights** must be protected against jet blasts and must be so arranged that they cannot be passed unnoticed.

• **Increasing use of helicopters** requires the development of special approach and landing area lighting.

• **When a pilot comes to a stop** in the middle of a two-mile-square airport at night, he often is lost. A second airplane is often on its way in behind him. Adequate guidance is needed to get him off the runway immediately and to mark his route to the ramp. Taxiway guidance lighting development is required since intersecting runways and taxiways can be confusing to pilots at night if the route is not properly marked.

Solution to these problems, according to Blatt, will be found within the lighting development facilities at Indianapolis, Ind., where tests are continually being conducted.

▶ **Study Programs**—The Indianapolis center is in the last stages of a long-range test and study program for establishing aircraft cockpit vision standards. A second long-range program, involving laboratory and flight measurements of pilots' reactions to various lighting arrangements has been started.

In addition, a long-range test and study program is in progress, Blatt said, to determine the special guidance lighting requirements for 300-ft. runways. He said success of the lighting test programs depends on the continuation of CAA-industry cooperation.

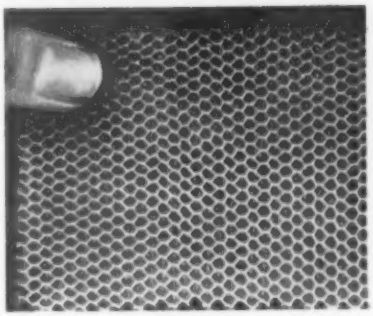
Fuel-Proof Paving Used at Idlewild

A gasoline and oil resistant plasticized synthetic rubber and tar topping has been installed on aircraft parking and service areas at New York's Idlewild International Airport.

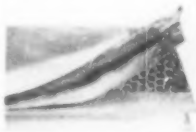
The topping, called surfa-aero-seal, has been developed by Naugatuck Chemical Division of U. S. Rubber Co.

Used extensively on military airfields, the rubber-based paving material was tested by Port of New York Authority for approximately two years before its application at Idlewild.

Reduce Weight Increase Strength *with* . . . HEXCEL HONEYCOMB



How many applications have you found for Hexcel Honeycomb? New uses are being discovered constantly for this man-made honeycomb that becomes *the strongest, lightest material yet developed,* when fabricated into a sandwich structure. Readily bonded to metal, glass, wood and other face materials it affords a smooth, rigid surface that does not ripple or "oil can".



Take this aileron trailing edge from the F86D Sabre Jet, for example. The 3/16" cell size Hexcel aluminum Honeycomb was bonded to aluminum sandwich skins with adhesives. It eliminated costly riveting and bracing, cut the aileron weight substantially.

Hexcel Honeycomb is available in aluminum, glass fabric, or cotton plastic, in several cell sizes and densities. **To learn more of its applications, write today for . . .**

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A LONG LOOK AHEAD **Fourth of a Series of Six Articles on Air Transport Markets in the Next Ten Years:**

BY THE McGRAW-HILL DEPARTMENT OF ECONOMICS

The Outlook for Business Air Travel

THE BUSINESSMAN of the 1960s is going to be more of a traveler. He'll have to be. Business is getting more and more national–and international–in its scope. And the tendency is to cover the nation, and the globe, with branch plants and branch sales offices, rather than trying to make and sell everything from one central location.

Of course, the executive doesn't always have to travel in person to see what's going on. There are other methods of communication that will be improved to give him reports on branch operations. Telephone, telegraph, TV and microwave will all be used as aids to centralized control. But there still will be an increasing number of situations where the man from the home office has to be on the spot, or where people from branches have to go to the central office themselves.

Here are some of the developments that are likely to mean more trips, and longer trips, by businessmen:

DECENTRALIZATION of manufacturing plants. The trend is to have several plants, each near its own market area. For example, all Ford cars were once made near Detroit for sale all over America. But today, Ford has new assembly plants in California, New Jersey, Georgia, and Kansas City, plus 16 scattered parts depots.

The same sort of decentralization is taking place in the steel industry, with plants now spread along the East and West Coasts, and in the Gulf South. More widespread use of the electric furnace in steel-making is expected to lead to still more, smaller units serving additional areas, away from the main steel centers. For a host of other products, from milk containers to industrial instruments, assembly plants are spreading out.

INTEGRATION of small companies into national corporations. This is a trend in fields where there are many small units spread around the country, such as in food processing, or pharmaceuticals. And mergers of two or more large chain operations are becoming more and more frequent. The control problem, and so the need for travel, grows when diverse plants acquire a central headquarters, just as it does when a parent company builds branch plants. In fact, integrating independent units–in fields that up to now have been "small business"–presents more of a problem than spreading out a single firm.

COMPLEXITY of industrial operations. Today's plants use raw materials shipped from many points. Tomorrow's plants will buy from areas even more widely scattered. More and more materials will come from abroad. Similarly, as machinery gets more complicated, more parts must be purchased (or manufactured) at more locations. The automobile industry, for example, now has an interest in the manufacturing of special steels, electrical systems and new plastics–all made away from Detroit. Thus, the purchasing agent's job is likely to involve more and more travel.

Also, engineers and designers will travel more to get information about the increasingly complex fields their companies are entering. They'll have to visit other plants, and take university training courses. For example, the advanced management courses now given at Harvard Business School and MIT might double their enrollment in the next 10 years. And more like them will be set up elsewhere.

CONVENIENCE–always a big factor in business travel–will be an increasing advantage for the airlines. As schedules are speeded up with the use of jets, the practicality of traveling to branch offices for conferences will be increased. Perhaps more important than speed will be the elimination of fatigue caused by long or uncomfortable journeys. As air travel becomes quicker, and fatigue is eliminated, it's going to get a more frequent space on the executive schedule. This applies particularly to older executives. Many of them can't stand the gaff of frequent trips today.

BUSINESS ABROAD will represent a gradually increasing share of U. S. business and will require an increase in travel. The American business sphere today is centered somewhere between New York and Chicago, with a radius extending to Canada and New England, to the Southeast, Gulf South and Far West. By the 1960s, this entire area will be more closely knit together by highspeed transportation. And the radius of business travel will stretch into Northern Canada, South America, West Africa and Western Europe–not just occasionally, but frequently.

BUSINESS IN WASHINGTON will continue to be a growth industry. The businessman never has to visit Washington as much in ordinary times as in national emergencies. The Korean boom, for example, is over. But the long-term trend is for more normal matters to require Washington consultation. Businessmen are going to be working for, or advising, the government more and more as time goes by. Government will keep extending the spheres of business in which the public has an interest. And if the system is to keep working fairly for private enterprise, businessmen will have to get to Washington to explain, advise and administer–as well as to get the information and rulings affecting their particular companies.

The fifth and sixth articles in this series will discuss other major factors affecting air travel in the changing economy, and the relationship between air travel and general business activity. Earlier installments Oct. 12 and 19, Nov. 23.

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CAB ORDERS

(Nov. 16-25)

APPROVED:

Northeast Airlines and Trans World Airlines and various other air carrier agreements relating to intercompany arrangements.

North Atlantic cargo rates revalidation as agreed to by joint traffic conferences of International Air Transport Assn. meeting in Honolulu.

United Air Lines and Trans-Canada Air Lines intercompany arrangements for rates for ground services and facilities at Vancouver Airport, B. C.; United and Stirling Transportation Service for ground transportation for personnel at Chicago.

Flying Tiger Line and Exportair for air-freight agency at New York.

Eastern Air Lines and El Al Israel Airlines for interline settlements; Eastern and Civil Air Transport for interline ticketing and agency.

Northern Consolidated Airlines and Thomas Anderson Transportation Co. for pickup and delivery at Anchorage, Alaska.

GRANTED:

New Orleans and its chamber of commerce leave to intervene in the permit renewal of TACA International Airlines, S. A.

Alaska Airlines pilots leave to intervene in the States-Alaska case.

Seaboard & Western Airlines exemption to operate one flight from Brussels, Belgium, to New York on or about Nov. 25, one from Stockholm to New York Dec. 14, and one from Munich, Germany, to New York Dec. 16. The passenger flights were called for under S&W's contract with the Intergovernmental Committee for European Migration (ICEM).

Spearfish and Deadwood, S. D., leave to intervene in the Spearfish suspension case.

Paul D. Choquette, Inlet Flying Service, exemption to employ pilots during periods of peak traffic.

DENIED:

North Central Airlines and Lake Central Airlines application for exemption to serve points in Indiana and Michigan on Chicago-Detroit routes.

J. Ashton Greene, International Air Forwarding Services, a letter of registration as an international airfreight forwarder.

United Air Lines petition for reconsideration of Board opinion that deferred decision on merits of the proceeding in the United restriction case.

BACA Airlines for temporary exemption to engage in certificated scheduled transportation of persons and property.

AUTHORIZED:

Wheeler Airlines to conduct aerial photography flights over 200 mi. of power line near Rutland, Vt.

Allegheny Airlines to inaugurate service on or about Dec. 1 at Butler, Pa.

Trans-Texas Airways to suspend service temporarily at Brady, Tex., until airport is adequate for its operations at that point.

PROPOSED:

Special civil air regulation authorizing the Administrator to issue air carrier operating certificates for helicopter operations.

ORDERED:

Pioneer Air Lines to show cause why Board should not fix, determine and publish a temporary mail rate for the airline pending fixing of final rates.

SUSPENDED:

United Air Lines service to Rock Springs, Wyo., again for a period during which Frontier Airlines is authorized to serve the town.

EXEMPTED:

Dean H. Goodwin from a part of economic regulations that would prevent him, as a pilot-owner carrier, from utilizing one Noorduyn Norseman aircraft in air transportation between points in first judicial division of Alaska and any other point in Alaska, British Columbia or the Yukon.

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SHORTLINES

▶ **Capital Airlines** carried the entire claims department staff of Markel Service, Inc., and several members of the executive staff of Aero Associates, Chicago insurance underwriters, to a recent safety meeting near Richmond, Va.

▶ **Compania Cubana de Aviacion** has announced extension of its international routes to Haiti. Constellations will be used.

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NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD

▶ **Colombian government** has purchased the first 50 acres of land for an international airport at Bogota, the nation's capital. Eventually 1,900 acres, costing $17 million, will be purchased. Total cost of the airport will be $50 million.

▶ **Denmark's Civil Air Traffic Division** has asked the Danish embassy in Washington, D. C., to obtain details of the new control tower at New York's Idlewild International Airport in connection with the tower planned at Copenhagen Airport at Kastrup.

▶ **International Air Transport Assn.** agreed at its air traffic conference in Hawaii to hold the next traffic meet in Italy during September of next year.

▶ **International Civil Aviation Organization's** Council has voted to convene a full conference of states concerned to review the entire problem of its ocean weather station program, now involving 25 ships manning 10 stations in the North Atlantic.

▶ **KLM Royal Dutch Airlines** carried 17% more passengers from January through September than during the same period last year. . . . Carrier begins twice-weekly Super Constellation service from New York to Tokyo Jan. 1.

▶ **Linea Aeropostal Venezolana** has asked Civil Aeronautics Board for renewal and amendment of its foreign air carrier permit to authorize transport of persons, property and mail between Maiquetia, Venezuela, intermediate points Havana, Cuba, and New York, and the terminal point of Montreal, Canada.

▶ **North Central Airlines** established a new airmail peak in October, carrying 10,401 ton-miles.

▶ **Pan American World Airways** has broken its Clipper cargo records between New York and Latin America, flying a total of 974,393 lb. last October. Old record was 871,113 lb. transported in February 1952. . . . PAA will install Zero Reader flight directors on its fleet of 15 trans-Pacific Stratocruisers.

▶ **Trans World Airlines** is improving its freight service by scheduling four transcontinental all-cargo "Skymerchant" flights daily. . . . TWA will be ready to inaugurate its proposed India-Ceylon-Tokyo service immediately upon government approval. . . . Company will start tourist service to Madrid, Spain, Apr. 1, at fares nearly 25% lower than any now in effect. . . . President Ralph S. Damon predicts the railroad sleeping car soon will find its place in history along with the stage coach.

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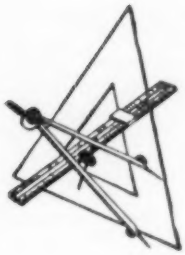

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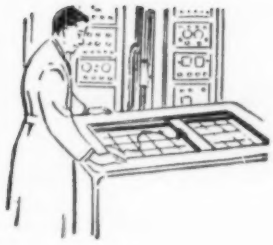

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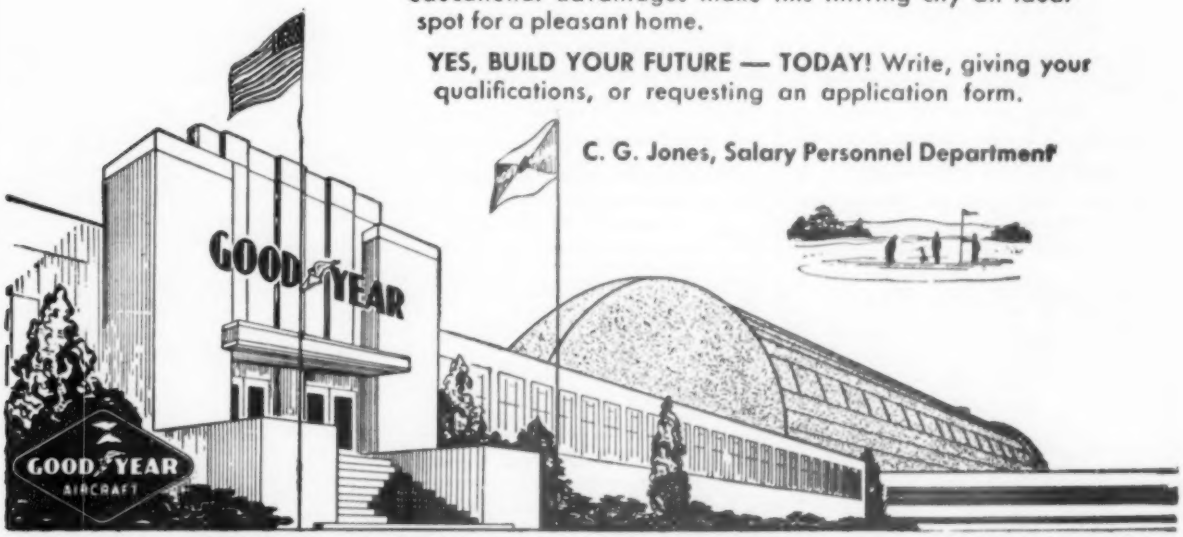

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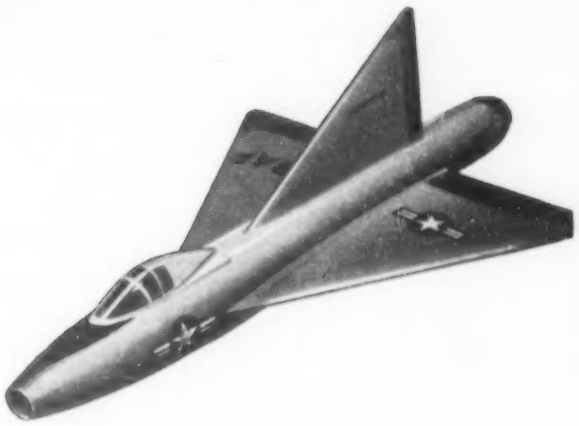

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Heater	Surface Combustion Co.	83A9	6
Heater	Stewart Warner (200,000 BTU)	921B	230
Blower	Dynamic Air Engine	4582-AA-6C	18
Blower	Joy Manufacturing Co.	U-709-15	24
Tank Unit	Minn. Honeywell	G-1098D	11
Trim Tab Controller	Pioneer	#15701-R	20
Oil Cooler Assembly	U.A.P.	U8416-MM	12
Oil Cooler Assembly	U.A.P.	U8013-MM	14
Hydraulic Pump	Vickers	MF9-713-15H	120
Hydraulic Pump	Vickers	PF12-713-25BCE	124
Hydraulic Pump	Vickers	PF4-713-20BCE	327
Hydraulic Pump/3000 P.S.I.	Vickers	MF45-3911-20Z	43
Hydraulic Cylinder	Air Associates	HC2109	29
Hydraulic Cylinder	Air Associates	HC2110	8
Fire Detector	Edison	117-47	46
Fire Detector	CO_2 Mfg. Co.	ASDC2	65
CO_2 Cylinders	Kidde	981280	185
CO_2 Cylinders	Kidde	M870036B	47
Anti-Icer Pump	Adel	D7818	125
Auxiliary Power Unit	Eclipse	NEP-2	29
Auxiliary Power Unit	Lawrence	LER-30D	16
Pump	Pesco	1EAR-280BH	15
Pump	Pesco	1E-621	8
Pump	Pesco	2E258SA	21
Separator	Pesco	3V-217-HC	32
Accumulator	Vickers	AA14002A	35
Actuator	Air Associates	M-2031	22
Wobble Pump (D-3)	Erie Meter	AN4014	17
Oxygen Cyl.	Kidde	923748	74
Windshield Wiper Kit	Marquette	K14949E	140

ENGINE ACCESSORIES

Starter	Eclipse	1416-12E	75
Generator	Eclipse (NEA-3A)	716-3A	100
Starter Motor	Jack & Heinz	JH950-R	90
Generator	G.E.	2CM46A2	4
Generator	Eclipse	1003-4	71
Carburetor	Stromberg	PD12K10	550
Carburetor	Stromberg	PR48-A1	236
Carburetor	Holley	1685-HAR	90
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Magneto	Scintilla	SF9-LN-2	407
Fuel Pump	Pesco	2P248EB	6
Fuel Strainer	U.A.P.	U635A	76
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Prop. Reversing Control	Ham. Standard	72400	20
Oil Separator	Eclipse	564-2A	384
Oil Filter	Purolator	27314	100
Pressure Relief Valve	Aerotec	V301B7	20
Tachometer	Eclipse	2227-11-D3A	11
Vacuum Pump	Eclipse	610-2C	6
Spark Plugs	Aero	LS4-AD1	185,000

AIRCRAFT ENGINES & PARTS

Engine	Wright	R-1820-52	1
Engine	Wright	R-1820-54	16
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Engine	P & W	R-1830-43	1
Bearing	P & W	1045A	166
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Nose Housing	P & W	84591C	77
Crankcase Assy.	P & W	84350-D	200
Pump Assy.	Wright Aero	420313	33
Drive Assy.	Wright Aero	416421	46
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AIRCRAFT ENGINES & PARTS (Cont.)

Description	Mfg.	Part No.	Quan.
Q.E.C. Unit		PY4M(B24)	17
Bearing	Torrington	NR6L12	25790
Bearing	Fafnir	AN200-K3L2	18273

GAUGES

Compass	Eclipse	36001-0	20
Gyro Indicator	Eclipse	14601-1F-B1	11
Gyro Indicator	Eclipse	10078-1AG	62
Position Indicator, Wheel & Flap	Weston	AN5780-2	400
Position Indicator, Wheel & Flap	G.E.	AN5780-2	1000
Position Indicator, Wheel & Flap	Eclipse	20100-11C-4-A1	23
Pitch Trim Gauge	Eclipse	15100-1B-A1	19
Cowl Flap Indicator	G.E.	8DJ29AAY	21
Oil Temp. Indicator	Lewis	77C3	23
Oil Temp. Indicator	Lewis	77C4	13
Oil Temp. Indicator	Weston	828TY13Z2	71
Manifold Pressure Gauge	Manning, Maxwell & Moore	AN5770-2	28
Manifold Pressure Gauge	U.S. Gauge (Metric)	AW2-3/4-25K	146
Fuel Quantity Gauge	Eclipse	3801-3B	128
Dual Carb. Temp. Gauge	Weston	828TY12Z2	40
Carb. Air Temp.	Lewis	77C3	22
Carb. Air Temp.	Weston	119862	40
Air Temp. Gauge	Weston	727TY70Z2	11
Air Temp. Gauge	Weston	727TY72Z2	85
Air Temp. Gauge	Weston	727TY73Z2	88
Air Temp. Gauge	Weston	727TY74Z2	83
Air Temp. Gauge	Weston	728-40Z2	10
Air Temp. Gauge	Weston	727-1Y37P	298
Air Temp. Gauge	Lewis	47B22	33
Air Temp. Gauge	Lewis	47B23	28
Air Temp. Gauge	Lewis	47B24	54
Air Temp. Gauge	Lewis	47B21	30
Cylinder Head Temp.	Lewis	76B19	8
Torque Indicator	Eclipse	20100-49B-14A2	9
Tachometer Indicator	G.E.	8DJ13ABK	6
Tachometer Indicator	Eclipse	2222-1F-2A	200
Magnesyn Pos. Indicator	Eclipse	20000-8A-14	9
Magnesyn Transmitter	Eclipse	20000-43A-13A1	8
Magnesyn Indicator	Eclipse	23000-2A	67
Pressure Transmitter	Eclipse	22101-11-A4	15
Pressure Transmitter	Giannini	47114-D2.0-20	8
Differential Pressure Gauge	Kollsman	906-6-011	22
Differential Pressure Gauge	Kollsman	254BK-6-052	48

AIRCRAFT (RADIO)

Transmitter	Bendix Radio	TA-12B	20
Receiver	Bendix Radio	RA10-D8	35
Amplifier (PB10) W/EDs Mount	Eclipse	15401-1	10
Amplifier	Eclipse	12086-1C	11
Radio Noise Filter	G.E.	1C-200	740
Radio Noise Filter	G.E.	NF10084	959
Tube		JAN6AL5	327
Standing Wave Ind.	Hewlett Packard	415A	3
Antenna Switch	Bendix Radio	MS49A	26
Control	Bendix Radio	3616	81
Station Box	Bendix Radio	3620	23
Insulator	Bendix Radio	MT48C	518

ELECTRICAL PARTS

Transformer	Eclipse	DW33	11
Transformer	Eclipse	DW28	80
Transformer	Eclipse	DW47	33
Transformer	G.E.	70G3	26
Servo Motor	Transicoil	#1300-20	57
Motor	G.E.	5BA40NJ1A	425
Motor	G.E.	5DP65-MB1	189
Motor	G.E.	5BA25D-J4B	44
Motor	Airesearch	26675	25
Motor	Diehl	FD65-5	21
Circuit Breaker	Spencer	PM-5	2094

ELECTRICAL PARTS (Cont.)

Description	Mfg.	Part No.	Quan.
Circuit Breaker	Spencer	C6363-1-5A	115
Circuit Breaker	Spencer	C6363-1-2A	115
Circuit Breaker	Heinemann	AM1614-80	1700
Circuit Breaker	Cutler Hammer	6141-H69A	237
Amplidyne	G.E.	5AM31JJ9A	31
Amplidyne	G.E.	5AM31NJ10	111
Switch	Kidde	A-4614	151
Ignition Switch	Scintilla	AN3213-1	70
Ignition Switch	Nesco	A-9(94-3226)	250
Master Switch	Jos Pollack	M862A	66
Thermo Switch	Fenwall	17322-2	126
Heater Control Switch	White-Rodgers	1033-4E1	287
Air Ram Switch	Minn. Honeywell	PG208AS1	148
Air Ram Switch	Minn. Honeywell	PG208AS7	40
Pressure Switch	Aerotec	M-101-B	20
Pressure Switch	Eclipse	3135-11C	88
Impact Switch	Kidde	SA/3A	18
Switch	C.H.	8909-K99	2000
Dome Light	Grimes	AN3096-4	2585
Dome Light	Grimes	AN3096-5	775
Dome Light	Grimes	AN3096-6	1365
Plug	Cannon	NAF310310-4B	2747
Plug	Cannon	NAF310310-5B	402
Relay	Leach	7964-404	47
Relay	Leach	7910	24
Relay	Allied	BCBX-2	31
Relay	Square D	82A	718
Relay	G.E.	CR2791-G100-K4	281
Relay	G.E.	CR2792F101-A3	626
Relay	Guardian	G344664	41
Relay	Guardian	G31502-A	350
Relay	C. P. Clare	D2060	45
Control Box	Vapor Car Heating Co.	9804B	34
Compensator	Vapor Car Heating Co.	46B311	25
Solenoid	Interstate Aircraft & Eng. Co.	A812	209
Flex. Cable	Airesearch	95439	66
Temp. Control	Fulton Syphon	715E	52
Noise Filter	Mallory	NF3-5	500
Regulator	G.E.	3GBD1A18A	13

VALVES

Valve	Kidde	982585	326
Valve	Oh. Chem.	AN60009-1B	395
Valve	Oh. Chem.	AN60009-2A	247
Valve (3000 PSI)	Parker	2-1046-76	47
Restrictor Valve	Parker	SP4-2746-77	68
Restrictor Valve	Parker	SP4-2746-78	105
Restrictor Valve	Parker	SP4-2746-79	40
Restrictor Valve	Parker	SP4-2746-80	48
Restrictor Valve	Parker	SP4-2746-81	60
Restrictor Valve	Parker	SP4-2746-76	142
Restrictor Valve	Adel	18784	33
Cone Check Valve	Parker	PL2-2546-75	127
Cone Check Valve	Parker	PL2-2546-76	123
Cone Check Valve	Parker	PL2-2546-77	690
Cone Check Valve	Parker	PL2-2546-78	540
Check Valve	Parker	PLY-843-54	112
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Check Valve	Kenyon	19100-2-1018	67
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Check Valve	U. S. Gauge	AW.CV-1-1	180
Valve	Parker	6-746-10	68
Valve	Vickers	AA31400	28
Restrictor Valve	Adel	18784	33
Lock Valve	Adel	12924-2	85
Brake Valve	Vickers	146102	22
Selector Valve	Parker	SP-1-445-8	7
Selector Valve	Adel	D9530	478
Selector Valve	Adel	D9530-2	668
Selector Valve	Adel	D9560-2	478
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Selector Valve	Adel	D9696	237
Selector Valve	Adel	D10044	744
Selector Valve	Adel	D10051	244
Solenoid Valve	United	37D6210 (AN4078-1)	2200
Magnetic Valve	General Control	AV1B1174	114
Throttling Valve		73-A-01	1865
Relief Valve	Airex	1265-900	240
Pressure Relief Valve	Aerotec	V301B7	20
Valve	Aero Supply	74247 (TyPH3)	814
Valve	Whittaker	AN5830-1	335
Valve	Whittaker	AN5830-6	74
Valve	Parker	AN5831-1	60
Valve	Eclipse	612-4A	130
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No Guests in Cockpit

One of the more embarrassing questions a domestic airline has to answer: "Can I see the cockpit?" This query comes daily from all manner of passengers, and after being faced with it for several years I conclude that there are two types of answers: one that makes you feel like a criminal, the other like a fool.

The reason for this psychotic bewilderment arises from various Civil Air Regulations and a conflicting variety of viewpoints. Generally speaking, an attempt has been made for years to prohibit all, save the assigned crew, to enter the sacred confines of the front office. The locked door and cockpit authority card are part of this philosophy.

▶ **Right Friends**—There was considerable leniency under the old CAR Part 61 as to who gained admittance. But as written, the new Part 40 practically requires that a person walk on water as the first step towards this shrine. That is, it makes no bones about who gets in via a CAB cockpit authority card. Without the card you are doomed.

Not that the card is so hard to get, of course. If, for instance you have a friend who is a vice president in charge of something or other he can get you one for the asking; doesn't matter who you are, naturally. But you do have to have the right friends.

To some extent this limited privilege helps the airline crew—to about the same extent it handicaps them. Possession of the card, you see, is no assurance that the holder will sit down and mind his own business, or even that he will pick the appropriate time to want in. Of course, the captain can say "No." But then the rookie cop can give a ticket to the holder of a police courtesy card, too.

▶ **Dog Tags**—So the question arises that since the captain has the power to deny entrance, why doesn't he also have power to grant it? Why are special privilege cards needed at all? The usual answer here is that it is strictly an identification card. Identification, my eye. Anyone I ever saw who had a reasonable connection with aviation had more dog tags than his wallet would hold.

What I'm thinking of in particular here is the admittance of pilots to the cockpit, especially other airline and military pilots in uniform. Any time I ever rode in a plane, especially a type new to me, I wanted to look over the cockpit. Other pilots usually do, too.

But nowadays you either give out with the criminal line, "Well, Bub, I'm not supposed to, see? But if you'll sneak up when nobody is looking, see? I'll let ya peek." Or else you feel foolish when saying "Gee, I'd sure like to, but, well, they have regulations. I'm sorry, wish I could, but . . ."

▶ **The Bother—How Come?**—Aren't these airline and military pilots trustworthy? A guy flies a B-47 loaded with atomic bombs, but he can't see Baltimore through a Constellation window. Beats me.

Seriously, the airline pilot appreciates not having to be bothered by every passenger on board. But it does seem that he should have something to say about whom he lets in. This arrangement apparently works well enough on overseas flights; no reason why it shouldn't work everywhere.

As stated before, a cockpit authority card is still no guarantee of good behavior, appropriate time or valid reason for entry. But it does eliminate some who have a perfectly normal, professional interest in aviation. Only they don't have friends.

(Editor's Note: AVIATION WEEK gives Capt. Robson an opportunity to express himself freely in this column. Comments from readers on his opinions are welcome.)

AVIATION CALENDAR

Dec. 7—Civil Aeronautics Board, second session of annual meeting on review of Civil Air Regulations, inter-departmental auditorium, Washington, D. C.

Dec. 8-10—Joint Computer Conference and Exhibition, sponsored by American Institute of Electrical Engineers, American Institute of Radio Engineers, and Association for Computing Machinery, Statler Hotel, Washington, D. C.

Dec. 14-15—Flight Safety Foundation, air safety seminar, Arrowhead Springs Hotel, San Bernardino, Calif.

Dec. 14-17—50th Anniversary Celebration of Aviation, Kitty Hawk, N. C. Program: Private Fliers and Aviation Pioneers' Day, Dec. 14; Aviation Industries Day, Dec. 15; Defense Day, Dec. 16; Anniversary Day, Dec. 17.

Dec. 17—Seventeenth Wright Brothers Lecture, U. S. Chamber of Commerce building, Washington, D. C. Aero Club Wright Memorial Dinner, Hotel Statler.

Dec. 17—Royal Aero Club dinner commemorating 50th anniversary of powered flight, Dorchester Hotel, London.

Jan. 8-11—Florida Air Pilots Assn., 11th annual air cruise, Miami, Fla.

Jan. 10-12—Institute of Surplus Dealers, trade show and convention, Madison Square Garden, New York.

Jan. 12-18—Society of Automotive Engineers, annual meeting, Sheraton-Cadillac and Statler Hotels, Detroit.

Jan. 18-22—American Institute of Electrical Engineers, winter meeting, Hotel Statler, New York.

Jan. 20-22—Operations Research in Production and Inventory Control, Case Institute of Technology, Cleveland. Speakers include Paul Stillson of Lockheed Aircraft Corp.'s Military Operations Research Division.

Jan. 25-28—Plant Maintenance & Engineering Show, International Amphitheater, Chicago. Conference will be held concurrently at the Hotel Conrad Hilton.

Jan. 25-29—Institute of the Aeronautical Sciences, 22nd annual meeting, Hotel Astor, New York. Honors Night Dinner Jan. 25.

Feb. 3-5—Society of Plastics Industry, ninth annual division conference on reinforced plastics, Edgewater Beach Hotel, Chicago.

Feb. 4—Instrument Society of America, ninth annual regional conference, Hotel Statler, New York. Aviation group will present papers on Progress in Measurement.

Feb. 21-23—Third annual Texas Agricultural Aviation Conference, Texas A&M College, College Station, Tex.

Mar. 22-25—Institute of Radio Engineers, national convention, Waldorf Astoria Hotel and Kingsbridge Armory, New York.

Apr. 5-6—Society of the Plastics Industry (Canada), Inc., 12th annual conference, Mount Royal Hotel, Montreal.

Apr. 29-30—American Society of Tool Engineers, 10th biennial industrial exposition, Convention Center, Philadelphia.

May 5-7—Third International Aviation Trade Show, sponsored by Aircraft Trade Shows, Inc., 71st Regiment Armory, New York.

May 17-20—Basic Materials Exposition and Conference, International Amphitheater, Chicago.

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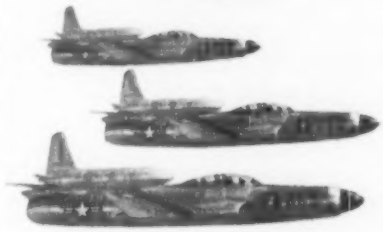

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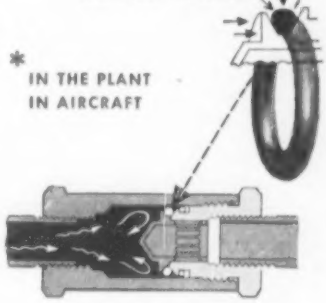

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LETTERS

Helio 'Bootstrap'

The article in the Nov. 23 issue (p. 37) on the twin-engine Helio design arouses in me more than casual interest and compels me to bring to your attention a major error in your reporting. Although Prof. Koppen was rightfully credited with previous Helio designs, he did not design the twin-engine airplane you have reported under the model designation H-6. I believe Prof. Koppen is too honest a man to be willingly credited for the work of others and, therefore, this article must have been printed without his prior knowledge. I am sure Prof. Koppen will confirm what I have said.

Actually the H-6, which originally was designated H-4, was designed by a group of research engineers and faculty of the University of Michigan in a highly concentrated schedule of night and weekend work. The group, of which I was project engineer, was engaged by Helio to design two airplanes, the H-6 (present designation) which we nicknamed "Bootstrap" and one other we called "Kestrel." Although we had access to a limited amount of Prof. Koppen's notes on the original two-place Helio plane and I personally had several visits with Prof. Koppen, prior to the start of H-6 work, to discuss his ideas on Helio-type airplanes, the actual writing of the specifications and the design of the H-6 were independent of his guidance. In fact, the first of this model that Prof. Koppen saw was the final copy of the preliminary design report, which was submitted for Wright Field evaluation.

For the record, these men were the designers of the Helio H-6: Richard Morrison, Harold Allen, Robert Cullen, Edward Lesher, Joseph Harris. Also contributing were: Stanley Reich, David Weiss, William Smelser, Julian Corey, Helen Clark.

Since the work of this group has been incorrectly credited to Otto Koppen, I would appreciate your checking the validity of this letter with him and then printing it verbatim.

WALLACE J. WILKIE
Research Engineer
Engineering Research Institute
University of Michigan
7465 Plymouth Rd.
Ann Arbor, Mich.

. . . And Teamwork

In accord with Mr. Wallace Wilkie's letter of Nov. 23 to you, Prof. Koppen and I should like to affirm that he and the very able task force assembled under his direction at the University of Michigan indeed deserve full credit for the specific Helio twin-engine design study described in your Nov. 23 issue.

Prof. Koppen's contribution to that design study was confined to his previous development of the basic concepts which he had by then reduced-to-practice on a small single-engine experimental airplane. In 1948, he had also demonstrated to the Fairchild Airplane Corp. that these design features are non-dimensional, and hence applicable to larger aircraft. Fairchild accordingly then entered into a license agreement with Helio Aircraft Corp. based primarily on a specific multi-engine configuration powered with Lycoming 260-hp. engines. However, a Fairchild stockholder proxy battle a short time thereafter overturned the management and this project, along with others attributable to the earlier management, was shelved.

Significant to Mr. Wilkie's question, and perhaps unknown to him, is the fact that a multi-engine model incorporating the identical engines and with the same size 15-ft. propellers had thus been proposed to Fairchild in 1948. Interestingly, Koppen's very rough performance approximations for take-off distance made at that time were within 7% of the careful calculations later worked out by Wilkie's group (for evaluation by the USAF Aircraft Laboratory at Wright Field).

Wilkie and his group were, however, asked to start from scratch without any reliance upon Koppen's earlier approximations for the multi-engine type. They were given the difficult assignment of simply taking the combination of principles and devices that Koppen had evolved on the single-engine experimental model and applying these to larger designs employing 260-hp. engines. The same ultra-short-field performance objectives were set as had been set for Koppen's earlier design work.

Full credit for the specific H-6 Helioplane design study and for its detailed performance calculations indeed goes to Wilkie and his University of Michigan group. Credit for demonstrating the way and for solving the fundamental control and stability problems that have heretofore made such ultra-short-field airplanes impracticable for normal uses goes to Prof. Koppen of MIT.

As is usually the case, the total accomplishment is the result of teamwork to which many contributed.

LYNN L. BOLLINGER
Chairman, Helio Aircraft Corp.
Norwood Metropolitan Airport
Norwood, Mass.

Super-92

Your Oct. 5 article "Forum Eyes More Powerful DC-3" states that Pratt & Whitney engineers turn "thumbs down" on the Super-92.

CAA approves the Super-92, executive Super-92 DC-3 pilots and operators without exception approve the Super-92, and a scheduled airline is preparing to change to Super-92. It has thousands of hours of executive DC-3 operation with no failures of any kind, structural or otherwise, and overhaul intervals and costs have been similar to or better than the -92. The Super-92 can hardly be dismissed in any serious article on improving the DC-3 with a casual statement that a competitor turns thumbs down on it.

P&W engineers had no part in the development of the Super-92 engine or complete knowledge of its design or components. Use of better cylinders is only one of the improvements made over the original -92.

P&W quite reasonably cannot be expected to look favorably on engines which give DC-3 over 200 mph. for $12,500 or less, complete and ready to go, when their own current production R2000s offer only 180–190 mph. for $30,350 per engine, plus unstated amounts for different propellers, oil coolers, airframe modifications, installations, etc. They also didn't think much of their own 75s on DC-3, but there have been no complaints from executive operators, and they are still much in demand.

We are presently preparing a file of engineering as well as operational observations to make available to AVIATION WEEK, operators, Pratt & Whitney, or any other interested parties, and will send a copy to Mr. Christian for his inspection.

G. S. WEAKS
Remmert-Werner, Inc.
Lambert Field
St. Louis, Mo.

Leeward's DC-3s

We wish to call your attention to an article in the Oct. 5 issue (p. 80) regarding the Pioneer Air Lines 2-0-2 subsidy.

In this article you state: "Pioneer temporarily chartered some of its DC-3s from Eastern Air Lines." Just for the record, this is not correct; all the aircraft were leased from Leeward Aeronautical Service and the aircraft leased were formerly owned by Eastern Air Lines. For the record, also, LeAir, Inc., is a wholly owned corporation of Leeward Aeronautical Service.

A. J. LEEWARD, General Manager
Leeward Aeronautical Service
Fort Wayne, Ind.

Erco's Simulator

Having read "AF Gets Assembly-Line F-86D 'Trainer'" in the Avionics section of AVIATION WEEK, Oct. 19, 1953, I would like to qualify one rather ambiguous statement.

The Engineering and Research Corp., in addition to being another supplier, originally designed, developed, and for over two years has assembly-line produced the selfsame F-86D "Flightronic" simulator.

KEITH C. FESSLER, Engineer
Engineering and Research Corp.
Hyattsville, Md.

Canberra's Altitude

The Aug. 31 AVIATION WEEK has just been drawn to my attention in view of the rather curious comments appearing on page 17 and column two, page 18. I do not think I need belabor the point with you that it is the Olympus-powered Canberra which holds the official altitude record, and that this was most certainly not achieved on a trans-Atlantic flight. . . .

C. B. BAILEY-WATSON
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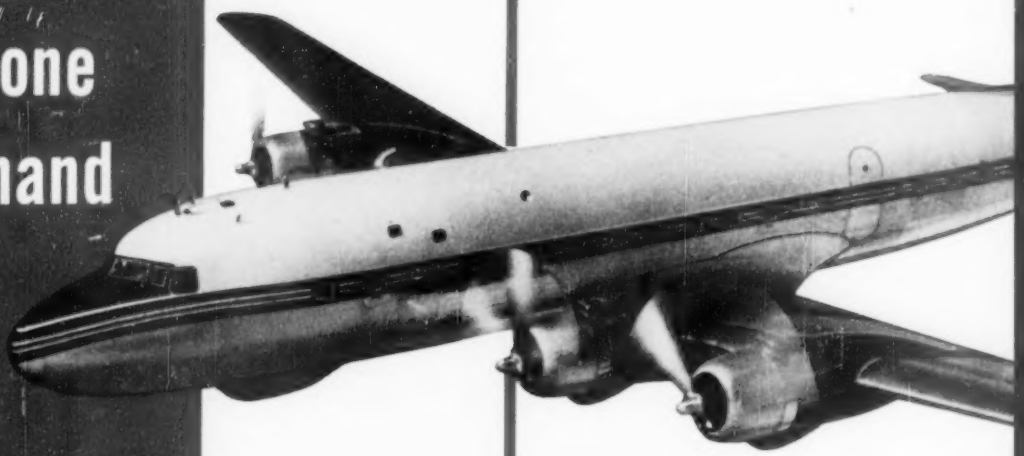

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